MACHINERY

Design—Construction—Operation

Volume 41 **FEBRUARY, 1935** **Number 6**

Thyratron control in electric welding has recently received much attention. What is thyratron control? What is a thyratron synchronous timer? The answers to these questions will be found in an article, *Seam Welding with Thyratron Control,* in March MACHINERY. Other subjects to be dealt with are the making of models from easily machined materials, and the vacuum method used in the making of aluminum-bronze die-castings. The second installment of the article *What a Shop Executive Should Know About the Heat-Treatment of Cutting Tools* will also appear in the March issue. The Ingenious Mechanical Movements section describes three unusual mechanisms.

Product Index 104-118

Advertisers Index 120

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 392-B

DEPARTMENTS

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York
ROBERT B. LUCHARS ..... *President*
EDGAR A. BECKER .. *Vice-pres. and Treasurer*
ERIK OBERG ..... *Editor*
FRANKLIN D. JONES ..... *Associate Editor*
CHARLES O. HERB ..... *Associate Editor*
FREEMAN C. DUSTON .... *Associate Editor*
LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.
Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.
Send old as well as new address.

Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879.
Printed in the United States of America.

MACHINERY

Volume 41 NEW YORK, FEBRUARY, 1935 Number 6

Advanced Die Design Extends the Field of Die-Casting

Expert Designing of Equipment and the Development of Better Die Steels Have Made Die-Casting Applicable to an Endless Variety of Parts

By CHARLES O. HERB

THE pronounced progress made in die-casting practice during recent years has largely resulted from the recognition of the fact that this process belongs to the machine shop rather than to the foundry. Mixing metals was once an important phase of successful die-casting, but with the present-day availability of ready mixed alloys of approved purity and specification, the important problems of die-casting have resolved themselves into those of providing dies of proper design for use on modern casting machines. Die-castings today are, therefore, definitely the work of the designing engineer and the diemaker; the tool-room has become an indispensable auxiliary of the die-casting department.

Complicated parts can now be die-cast with comparative ease because of the complete mechanization of the die-casting process. Dies that are fully automatic, even to the operation of numerous cores, have proved successful for a large variety of parts. An outstanding advantage of the automatic dies is that their mechanical movements can be accurately

timed and positively carried out in the most ideal sequence for the individual part. Automatic dies have also done away with arduous labor, speeded up die-casting, and eliminated the uncertainty and hazards of the human element.

Die-casting is not confined to quantity production. Small hand-operated and semi-automatic machines have become popular of late with manufacturers who are outside of the mass production class. These machines, however, also possess high production possibilities in the casting of small parts. Better steels have so increased die and core life that the die-casting process offers even greater economies than in the past.

The widespread interest in die-casting that exists at the present time has led MACHINERY to prepare a series of articles on the design of the dies used. These articles will emphasize the advances made in die-casting practice since the publication of a series of six articles entitled "Design of Automatic Die-Casting Dies," which appeared in MACHINERY beginning with May, 1930. The dies that will be described in the new series are developments of the Madison-Kipp Corporation, Madison, Wis. Patents have been applied for or granted on many of the core movements that will be considered.

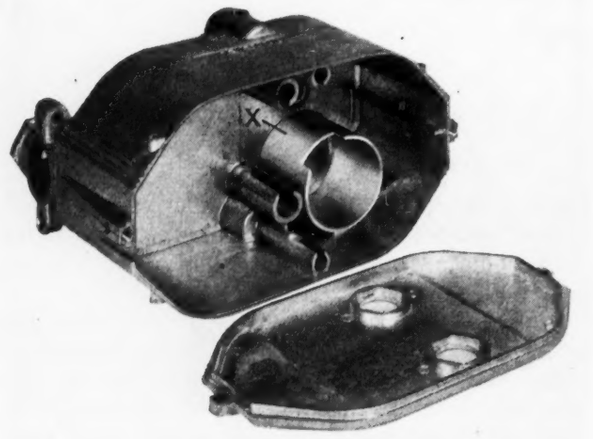


Fig. 1. Extensive Sections Only 1/16 Inch in Thickness are a Feature of This Die-casting

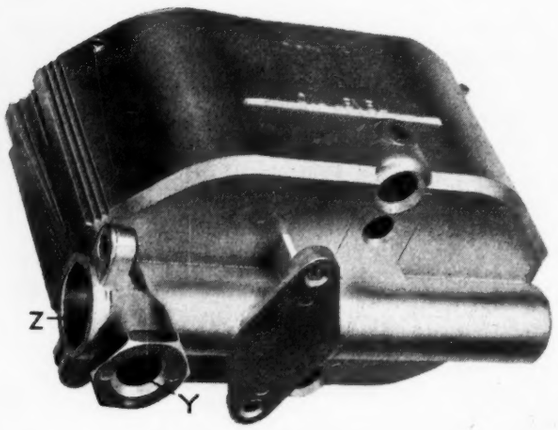
Product Designers Should Consult Die-Casting Experts

From the examples to be presented in this article it will be apparent that, in designing die-casting dies, many questions arise that can be decided only upon the basis of considerable experience in the art. Before settling upon all the details of a part that is to be cast in dies, the product designer would find it advantageous to consult with a die-casting specialist. The latter can usually suggest slight changes that will greatly reduce die cost and at the same time result in better castings. Sometimes it may be cheaper to drill a hole than to core it.

One thing that the product designer should bear in mind is that when decimal dimensions and close tolerances can be avoided, the cost of dies will be greatly decreased. Some engineers seem to think only in terms of plus or minus 0.001 inch, when fractional dimensions will suit the purpose as well.

One of the important developments in the last few years has been the casting of thin sections. In cases where both thin and thick sections are required in the same casting, the designer must carefully study the flow of the metal in the die, and by water-cooling or the application of heat, provide for a uniform flow to all parts of the die cavity.

Fig. 2. The Bottom of the Oil-burner Float-valve has a Tubular Section with a Long Cored Hole



The oil-burner float-valve illustrated in Figs. 1 and 2 has an outer wall only 1/16 inch thick, although the over-all length of the part is approximately 5 5/8 inches and the inside height of the wall is 2 1/2 inches. This part also contains a cylindrical well *X*, which has a wall thickness of 1/16 inch. Integrally cast with the thicker bottom of the part is a long tubular section that is closed at one end. The hole *Z* in the tubular section is cored to a diameter of 13/16 inch. One of the special mechanical features of the dies used in casting this float-valve is the means employed for removing the long tube core at the end of the operation.

Features of Dies Used in Casting the Oil-Burner Float-Valves

The dies used in producing the oil-burner float-valve are illustrated in Fig. 3, the movable die being shown at the left with the various sliding members in the closed or casting position, and the stationary die being shown at the right. Fig. 4 shows the same dies, but in this illustration the movable die is shown with its sliding members in the open position for ejecting a die-casting. It will be apparent from these illustrations and from the construction drawing, Fig. 5, that the parting line for the casting runs around the top edge and also through its vertical center line, as shown in the left-hand view of Fig. 5. The entire piece is cast in the movable die member, the stationary member serving merely to close the die and to hold the cores for producing the various holes and openings.

Four holes are produced partially by cores in the stationary die and partially by cores in the movable die, the cores of the stationary member being piloted in holes in the movable-die cores. These cores are seen at *A* and *B*, Fig. 3, on the movable die and at *C* and *D* on the stationary die. The construction of these piloted cores is shown in the upper right-hand view of Fig. 6. On the stationary member in Fig. 3 may be seen the top of the deep narrow circular cavity that is formed by cores *E* and *F* to produce well *X*, Fig. 1. At *G* in the upper left-hand view of Fig. 6 is shown a core that must be seated closely and slightly off center on core *H*, which produces the long hole *Z*, Fig. 2.

Gating is an important factor in the design of die-casting dies. From a study of Figs. 3 and 4, it will be seen that generous runners in both the movable and stationary members of the die carry the molten metal to the two sides of the cavity. These runners are 3/4 inch wide and are about 5/16 inch deep in each die half up as far as the lower edge of the movable die slides. From there on there is a runner in the stationary die only to the point where the metal enters the die cavity. Then runners are provided in the slides to a depth of 0.045 inch. At the points where the metal is forced into the die cavity, however, the total depth of the opening on each side is only 0.045 inch, but the opening is approximately 4 inches long.

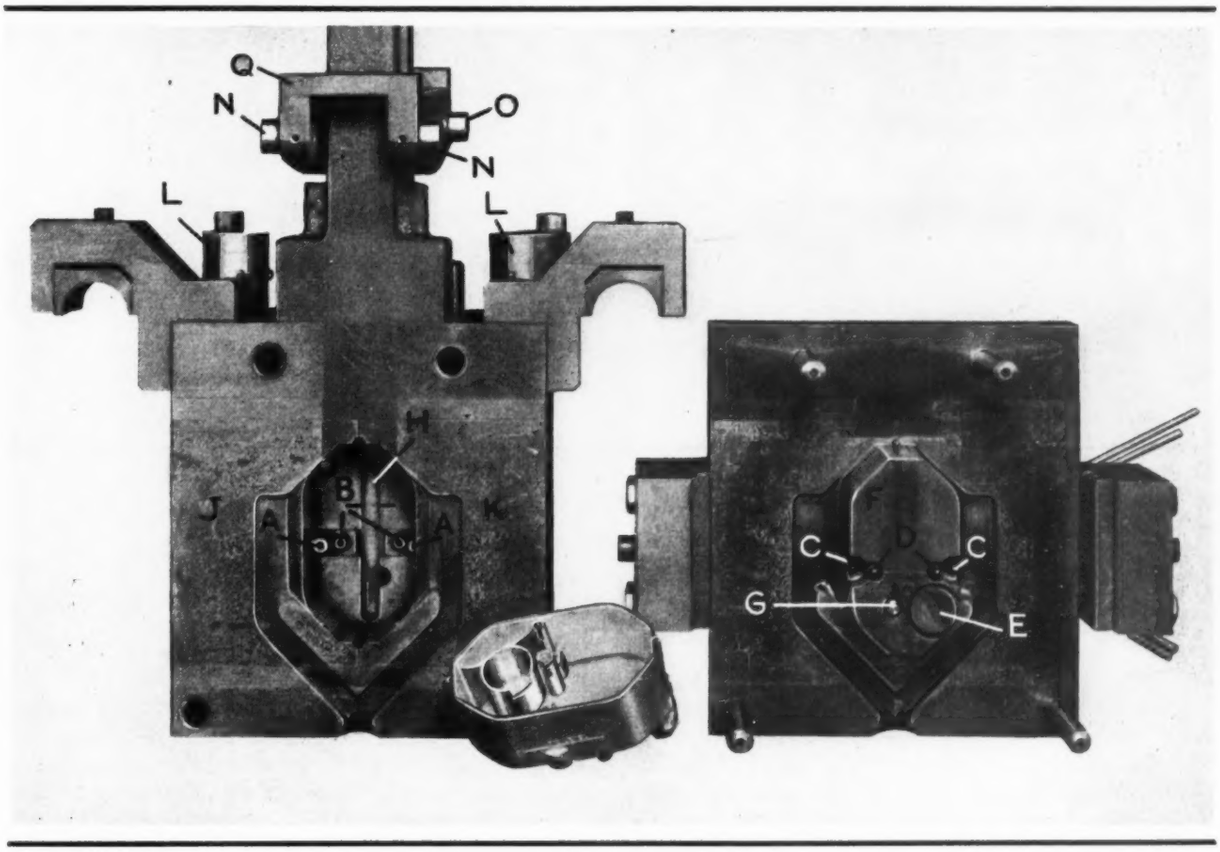


Fig. 3. Dies Used in Producing the Oil-burner Float-valve. The Movable Die at the Left is Shown with its Two Slides and a Moving Core in the Closed or Casting Position

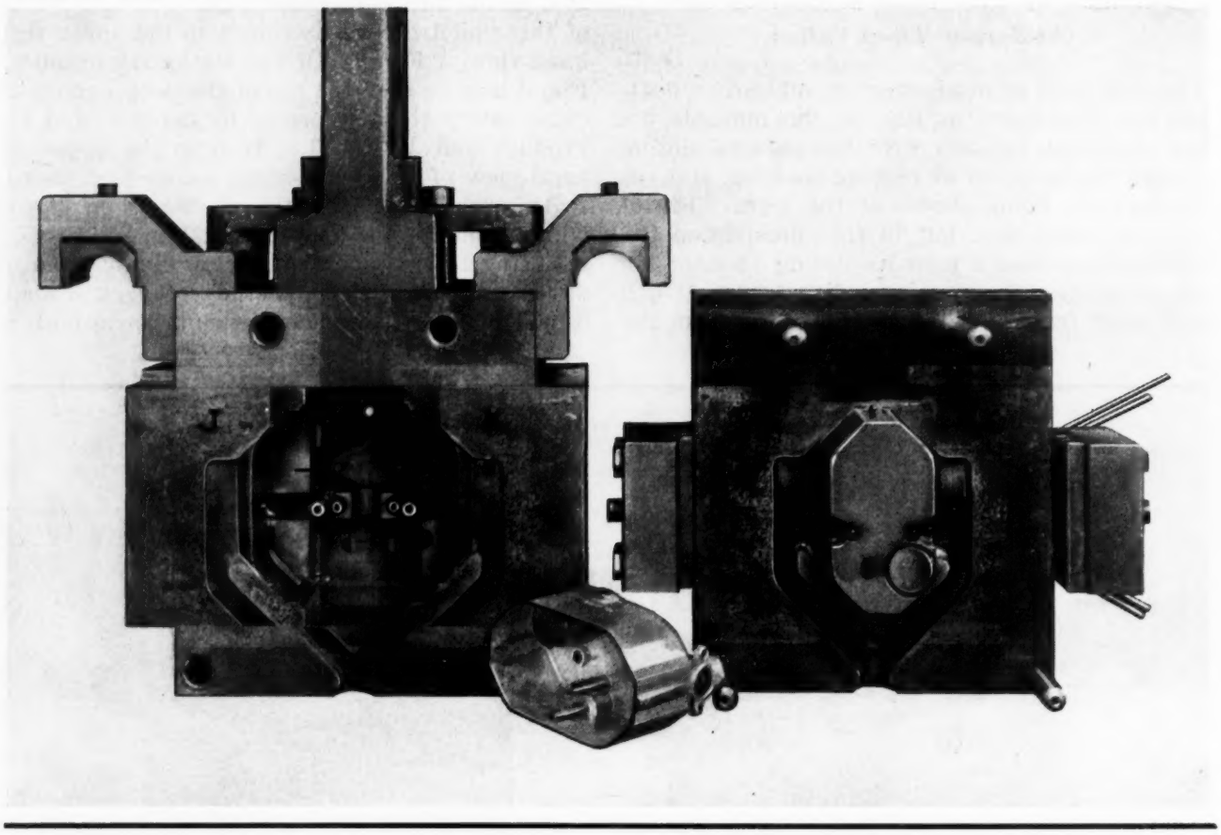


Fig. 4. Another View of the Dies Shown in Fig. 3, with the Various Sliding Members of the Movable Die in the Open Position for Ejecting a Casting

In the operation of these dies, the regular equipment of the Madison-Kipp die-casting machines carries the movable member away from the stationary member. The two slides *J* and *K* of the movable member and core *H* are operated simultaneously. The two slides are moved 2 1/2 inches apart as the rollers on the end of crank-arms *L* (see Fig. 5) move along a cam path in the faces of horizontal "combination bars" *M* at the top of the machine. The crank-arms are mounted at the top of pinion shafts *S*, which engage racks fastened on the back of slides *J* and *K*. Thus the slides are operated by the action of crank-arms *L*. These arms swing 95 degrees into the position shown dotted at the right-hand end of the diagram at the bottom of Fig. 6.

At the same time, core *H* is broken loose from the casting in two quick jerks and is then withdrawn at a uniform rate from the casting. These movements are actuated by rollers *N* and *O* on a link *Q* that is pivoted on a pin *P*, Fig. 5, held in a slotted arm attached to the top of the movable die. Rollers *N* and *O* move along cam paths in the vertical faces of combination bars at the top of the machine. As the movable die starts to recede from the stationary die, roller *O* moves up a short incline in its cam path while roller *N* continues to move horizontally. This causes a long leverage action of link *Q* with roller *N* as the pivoting point. The result is that pin *P*, core-holder *R*, and core *H* are raised one-half the vertical movement of roller *O*, or about 5/32 inch. The action is a quick jerk that loosens core *H* from the casting.

As roller *O* then advances horizontally, roller *N* strikes a short incline, with the result that link *Q* pivots on the axis of roller *O*. This gives a second quick jerk that completely loosens core *H* from the casting. From this point, rollers *N* and *O* simultaneously move up inclines of the same angle, thus raising core *H* from the die. All other cores of these dies are fixed in either the movable or stationary members. However, several cores on slides *J* and *K* are withdrawn from the casting when these slides are opened sidewise.

Ejection of the casting from the movable die is accomplished by means of ten long slender pins *U* mounted on plate *T*. This occurs when four rods *V* strike stops on the machine as the withdrawal of the movable member ends. The ejection of the casting is facilitated because its large box-like exterior is slightly tapered. When the movable die again advances to the closed or casting position, the

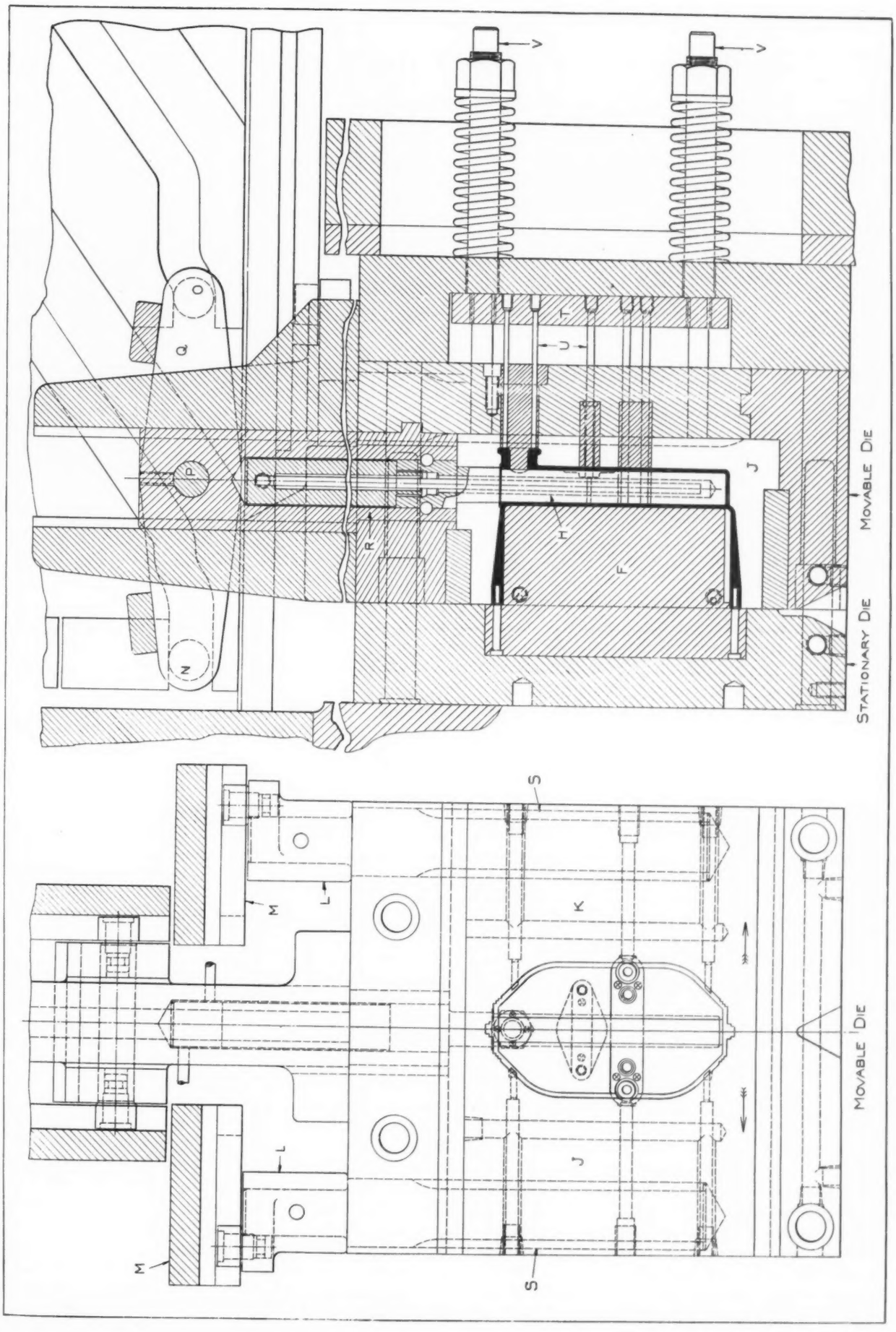


Fig. 5. Construction Drawing, Showing the Mechanisms for Operating the Slides and Long Core of the Dies Shown in Figs. 3 and 4

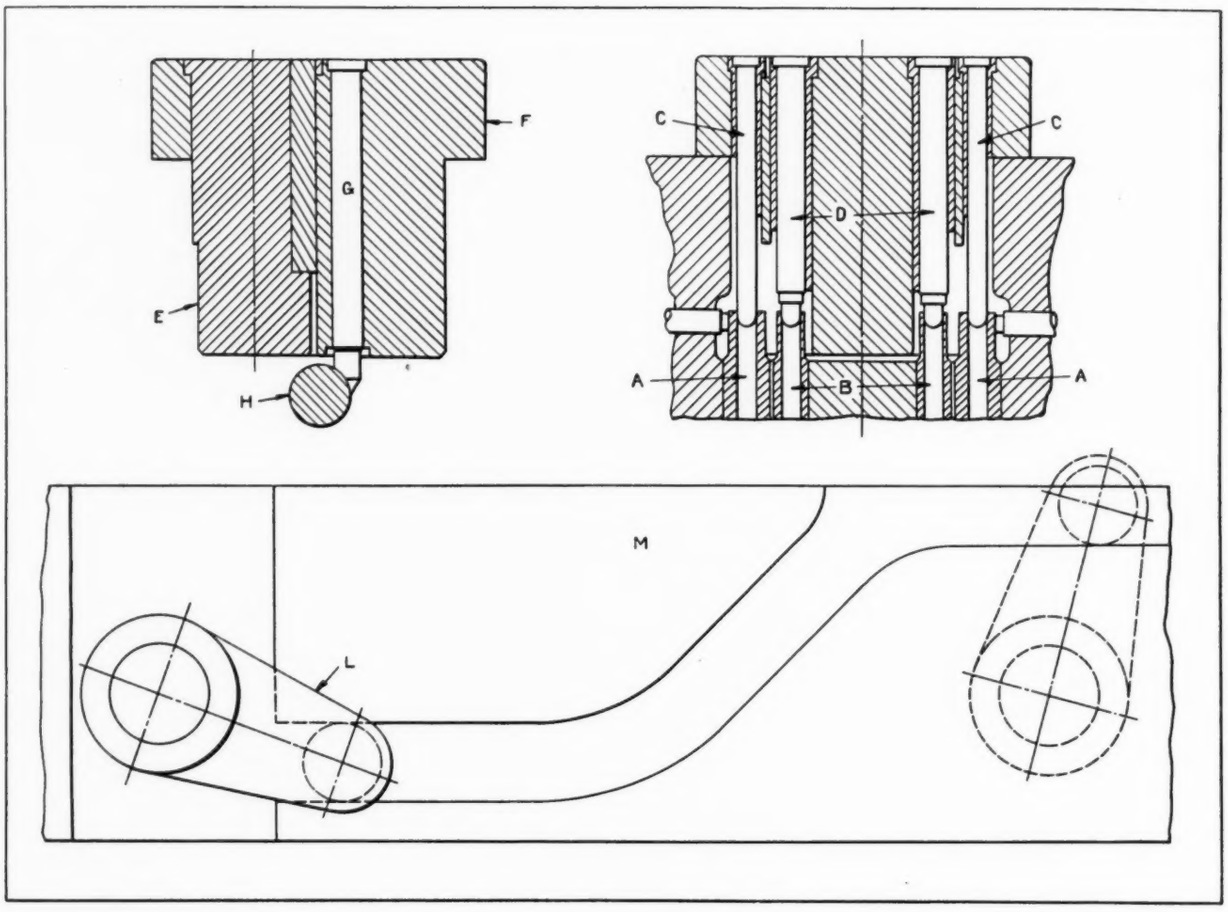


Fig. 6. Details of Various Cores in the Dies Shown in Fig. 5 and a Diagram of the Cam Path that Actuates Crank-arms L

springs surrounding rods *V* pull plate *T* back and thus withdraw the ejecting pins to the bottom surface of the die cavity.

In this die, core *H* is water-cooled for practically its entire length. Water is also circulated through slides *J* and *K* and across the bottom of both the movable and stationary die members, so as to control the temperature of the dies in the vicinity of the sprue hole.

Rapid Production and High Quality Castings are Features of the Die-Casting Process

Die-casting production depends upon the amount of metal to be cast in wall sections, the size of the casting and other factors. In the case of the oil-burner float-valve, about two pieces can be produced per minute. This part is cast from zinc, which has become especially popular for die-casting because of its comparatively low melting point (approximately 810 degrees F.) and because zinc alloys are now available that give tensile strengths as high as 50,000 pounds per square inch. When lightness is a factor, aluminum alloys are used, as they are about 140 per cent lighter than zinc, or else magnesium, which is one-third lighter than even aluminum.

Proper Venting of Dies

Proper venting of dies is another matter that requires considerable experience. Generally speaking, when moving cores are provided, the slight amount of clearance around the cores allows sufficient venting. Sometimes enough air can escape between the faces of the two die halves, but, of course, there must not be sufficient space to permit the molten metal to flow out. Frequently dies are made and tried out before the matter of venting is considered at all.

Other articles in this series on the subject of die-casting dies, to be published in coming numbers of MACHINERY, will deal with dies for automatic, semi-automatic, and hand-operated machines. There will be included dies for casting parts from zinc, lead, aluminum, and magnesium alloys. Some of these dies are designed for casting as many as four different parts at the same time.

The Increasing Application of Hard-Facing

The Hard-Facing Method of Adding to the Wear-Resistant Properties of Equipment Subjected to Severe Abrasion is Being Used to an Ever Increasing Extent. The Present Article Summarizes Recent Experience with Hard-Facing

IN a paper read before the thirty-fifth annual convention of the International Acetylene Association, E. E. Le Van of the Haynes Stellite Co., Kokomo, Ind., brought out a number of points pertaining to hard-facing that are of interest in any branch of the machinery industry, although Mr. Le Van made particular reference to steel mill equipment.

Briefly, hard-facing may be defined as the process of welding to wearing parts a coating, edge, or point of a metal that is highly resistant to abrasion. Depending on the type of hard-facing alloy used and the service to which it is subjected, hard-faced surfaces will outlast steel from two to twenty-five times. As a rule, wearing parts are not hard-faced until they are worn in service, but the hard-facing process is applied equally well to new parts before they are installed. Besides the longer life of equipment, other cost-reducing features of the hard-facing process are: Fewer replacements and uninterrupted production, with resultant savings in labor charges and in lost time for shut-downs; salvaging of worn parts from the scrap heap; savings in power; and a general increase in operating efficiency. The actual economies derived from the use of the hard-facing process are often amazing.

Different Classes of Hard-Facing Materials

The selection of the proper hard-facing material for a given job is of considerable importance, especially as these materials cover a wide range of strength, hardness, wear-resistance, and weldability. However, there are three general groups of hard-facing materials, one of which is essentially a high-alloy steel having considerable strength and toughness, but comparatively small resistance to abrasion. Materials in this group are used primarily for hard-facing gyratory crusher mantles, crusher jaws, dipper teeth and similar parts subjected to severe shock and impact, giving the rebuilt parts at least twice their usual life at only a fraction of the cost of new parts.

Another class consists of the tungsten carbides, the so-called diamond substitutes, which cannot be applied like welding rods by melting in the oxy-acetylene flame, and are, therefore, used in cast pieces of various sizes which are held in place by a binding material. The diamond substitutes have found widespread use for hard-facing oil-well drilling tools.

The third class consists of the non-ferrous alloys of cobalt, chromium, and tungsten. These are most important to the steel industry, because of the prevailing high temperatures of many of the operations in that industry. To obtain maximum efficiency and increased life of wearing parts under these severe conditions, it is essential to hard-face them with an abrasion-resistant alloy that will maintain its hardness at high temperatures.

Besides red-hardness and abrasion resistance, other valuable characteristics of the non-ferrous hard-facing alloys are their excellent welding properties and their low coefficient of friction. The latter quality is of considerable importance, since with less friction, less surface heat is developed in contacting parts. For example, rapid wear made it necessary to replace a steel shaft every week and the bearing in which it turned every two weeks. Hard-facing the shaft with a non-ferrous alloy not only increased the life of the shaft, but also increased the life of the plain steel bearing five times. Wherever lubrication is impossible or unreliable, or abrasion severe, the use of non-ferrous hard-facing materials has become generally accepted. In the last few years, the hard-facing process has advanced to such an extent that today there are literally thousands of hard-faced wearing parts in practically every industry.

Examples of Increased Wearing Properties Through Hard-Facing

A few examples of the application of wear-resistant alloys may be of interest. The application of hard-facing to water-cooled pokers in the steel industry increased the life of these parts from about three months to over two years. Carbon scrapers in coke-oven operation which, when made from ordinary steel, used to wear out about every three days, lasted seventy-five days when hard-faced. A coal-pulverizer hammer, the average life of which, when made from tool steel, was equivalent to 38,000 tons of pulverized coal, after being hard-faced was used for pulverizing 223,000 tons of coal.

The heat- and abrasion-resisting qualities of the hard-facing material are also well illustrated in its application to stationary blades for the hot-shear-

ing of squares and rounds. One hundred kegs of 1 1/8-inch square nuts is the average production of regular steel blades, as compared with an average of 1500 kegs with hard-faced shears. Hard-faced shear blades used for cold-shearing 1/8-inch steel sheets last from two to three times longer between grinds than hardened steel shears.

One of the greatest savings that hard-facing has effected in the iron and steel industry has been on the different types of guides used in rolling mills. In one large mill, a cast-steel guide on the first finishing operation of the rail mill had to be changed every seven days and had to be reground every three hours. A hard-faced guide has run ten weeks on this operation without change. In another steel plant, hard-faced entry guides on continuous bar and billet mills have shown a life of 6 to 1 over ordinary steel guides. This has resulted in reducing the inventory of guides from 500 to 100 in this plant.

Punches and dies are another important hard-facing application. In one case, ordinary steel punches lasted, on an average, for only about 800 holes. A hard-faced punch, after having punched over 1600 holes, appeared just as good as new. In another case, a hard-faced punch for blanking a 4 3/4-inch diameter center hole in forged-steel car wheels at a temperature of 2000 degrees F., lasts from sixteen to thirty times longer than the large cast-iron punch formerly used. The hard-faced punch also leaves a cleaner hole.

At an Alabama steel plant, another application is working out well. This is the hard-facing of conveyor rolls and shaft bearings used in heating furnaces. The rolls operate in a temperature of 750 degrees F., and it is impossible to lubricate the bearings. After thirty days service, the hard-faced bearings showed no signs of wear.

Another interesting application is the hard-facing of exhaust valve inserts and valves for automotive and aircraft gasoline engines. Several prominent manufacturers of heavy-duty trucks and buses hard-face the exhaust valve seats with non-ferrous cobalt-chromium-tungsten alloy. While ordinary cast-iron seats and inserts must be ground after every 10,000 miles of operation, records of as much as 200,000 miles of service have been reported before regrinding the hard-faced valves. The performance of these special hard-faced valve seats indicates that such seats will outlast the life of most passenger car motors.

How Hard-Facing Materials are Applied

Hard-facing materials can be applied by either the oxy-acetylene or the electric arc method. For the non-ferrous alloys and many of the ferrous alloys, however, the oxy-acetylene method is usually recommended. Practically all types of metals can be hard-faced with non-ferrous welding rod, but there are three important points that should be kept in mind: (1) The surface to be hard-faced should be thoroughly cleaned; (2) an excess acetylene flame should be used; and (3) the surface should be brought to a sweating heat only and not melted. As little as one ounce of material is applied on some parts and as much as 200 pounds on others. Whether an ounce or 100 pounds is used, the result is invariably a gratifying saving in maintenance and production costs.

Census of Machine Tool Accessories and Machinists' Tools

The Census of Manufactures for 1933 covering machine tool accessories and machinists' precision tools and instruments has just been published by the Bureau of the Census, Washington, D. C. According to the figures published, in 1933 there were 587 shops manufacturing equipment and tools of this kind, employing an average of 13,726 men. The total value of the machine tool accessories and machinists' precision tools and instruments produced was $36,831,000 as compared with $59,959,000 in 1931, and $134,273,000 in 1929. The following subdivisions of products may be of interest:

Chucks	$714,031
Machine vises	81,099
Lathe attachments	103,721
Boring, drilling, and milling machine attachments	804,637
Special equipment	22,500,685
Arbors, collars and collets	164,477
Counterbores and countersinks	160,492
Drills	4,508,073
Hobs	483,784
Milling cutters	3,658,187
Reamers	1,220,359
Taps, except pipe threading	1,847,588
Dies, except pipe threading	651,534
Pipe taps	405,490
Pipe dies	456,339
Pipe stocks with dies	649,890
Thread chasers	1,017,760
Precision measuring tools	185,868
Gages (plug, ring, snap, thread, etc.)	761,060

Employment in this industry increased greatly during 1933. While there were only 8744 wage-earners employed in the industry in March, 1933, this figure rose to 19,709 in December of that year, the average for the entire year being 13,726, as mentioned. No statistics are available showing employment at the present time, but since employment fell off slightly in the machine tool industry, it may be reasonably assumed to have decreased slightly from the December, 1933, high in the small tool industry as well.

Mechanisms for Controlling Lead-Screw Feeds

Improved Mechanisms Designed to Facilitate Engagement of Lead-Screw Nut and Lengthen the Life of Parts Subject to Wear—Second of Two Articles

By M. A. HOLLENGREEN, Assistant Chief Engineer
Landis Machine Co., Inc., Waynesboro, Pa.

LEAD-SCREW mechanisms of different designs were illustrated and described in January MACHINERY, page 289. The present article deals primarily with details of lead-screw design that have been developed to insure a higher degree of accuracy in the functioning of such mechanisms.

Backlash Take-Up Necessary to Insure Lead Accuracy

When it is necessary to hold the lead accuracy within limits of one or two thousandths of an inch, some form of backlash take-up must be provided to compensate for wear. Numerous methods have been devised to accomplish this take-up, but the form shown diagrammatically in Fig. 6 has proved to be the most advantageous in actual practice, from the standpoint of effectiveness and cost.

The wear, as a rule, occurs on the lagging flank of the lead-screw nut thread. This worn condition allows a certain amount of longitudinal movement of the carriage or mechanism being traversed, with reference to the lead-screw, because the thread in the nut does not completely fill the groove in the lead-screw. Then, should the carriage have a tendency, for some reason or other, to run ahead of the lead-screw, it would be free to do so until the backlash were taken up. This would cause a lead error in the finished product.

Design of Backlash Take-Up

The upper view in Fig. 6 shows a partial cross-section of a mechanism with an adjustable segment *A* for backlash take-up. The lead-screw *B* revolves in the direction indicated by the arrow and forces the half-nut *C* against the carriage casting *D*. The half-nut is carried in the jaw *E*. This view shows

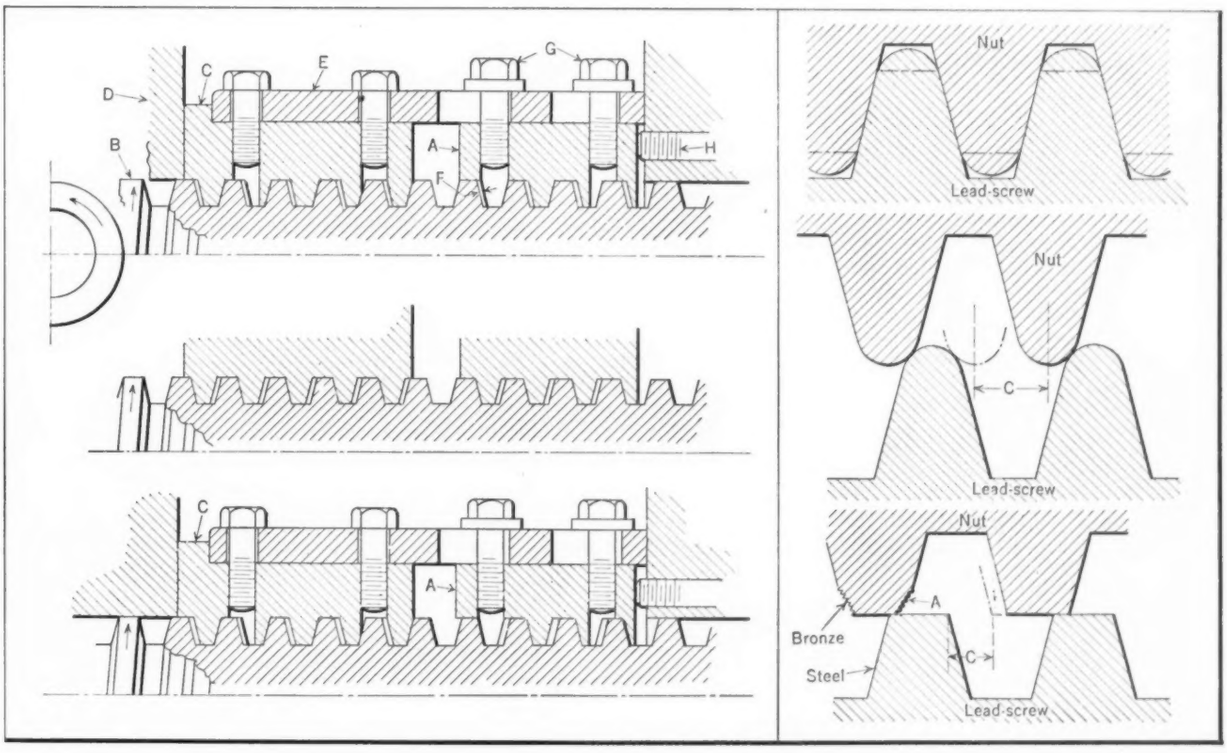


Fig. 6. Details of Lead-screw Nut Take-up that can be Adjusted to Eliminate Backlash

Fig. 7. Rounding Crest of Lead-screw and Nut Facilitates Engagement

the mechanism after it has been in service long enough for the nut to develop a clearance *F* due to wear. The amount of wear or clearance *F* represents the distance between the leading flank of the nut and the lagging flank of the lead-screw. Now should the nut run ahead of the lead-screw, the mechanism would assume the position shown in the middle view and the lead-screw would tend to hold the carriage back instead of pushing it forward.

To overcome this condition, the clamping studs *G* of the adjustable segment *A* are loosened and the adjusting screw *H* is turned, moving *A* to the left, as shown in the lower view. Now the half-nut *C* again bears on the leading flank of the lead-screw and the adjustable segment *A* bears on the lagging flank so that the mechanism cannot move with reference to the lead-screw. Thus, the rate of travel of the carriage is positively controlled by the lead-screw.

A practical application of this type of backlash adjustment is illustrated in the mechanism shown in Fig. 8, which has proved very successful in actual practice. This mechanism differs from the ones previously described in that it has two supporting pivot shafts *A* and *B*. It is comparatively expensive to manufacture, but the increased accuracy of lead offsets the additional cost. The view in the upper left-hand corner of Fig. 8 shows the locking mechanism which is combined with the shaft *A* at a point near the operating handle.

The pawl *C* is mounted on an eccentric which allows it to be adjusted to the correct position when the nuts are closed on the lead-screw. The automatic trip-rod *D* is actuated by an adjustable stop.

Section *Y–Y* shows the mechanism in the open position. The spring that exerts the opening pressure is shown in this view at *S*. The direction of the lead-screw rotation, as indicated by the arrow in this view, is such that the lead-screw tends to wrap the bronze half-nuts into closer contact with the lead-screw rather than to force them away from it. Section *Z–Z* shows the method of oiling the lead-screw threads. A porous wooden plug *P* is inserted in the bronze half-nut before it is tapped so that the thread form is tapped into the wooden plug. As this plug becomes saturated with oil it leaves a film on the lead-screw. Section *X–X* shows a practical application of the backlash take-up arrangement illustrated in Fig. 6.

Mechanisms Designed to Engage Lead-Screw Nut

Four different lead-screw nut mechanisms are shown diagrammatically in both the open and closed positions in Fig. 9. At *A* is shown a mechanism

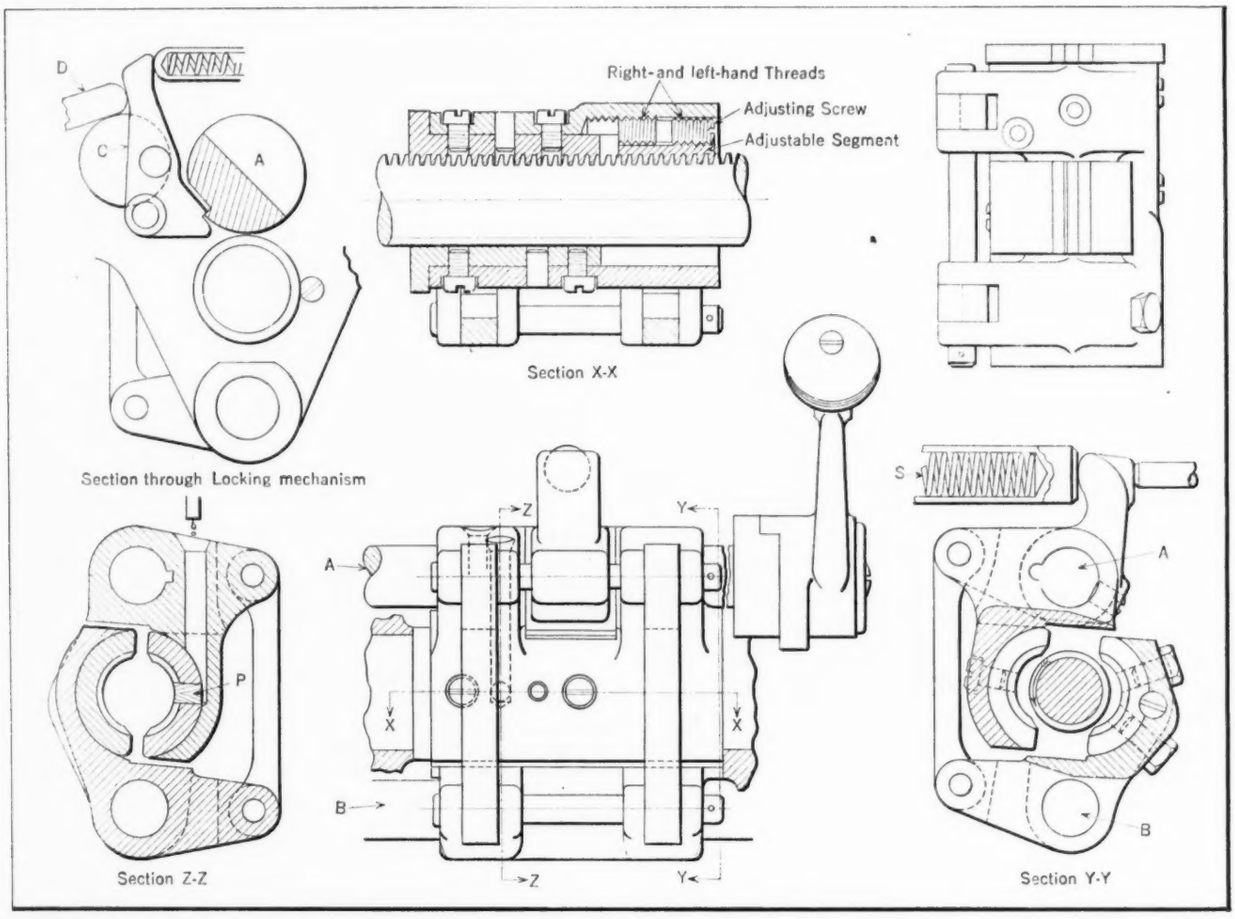


Fig. 8. Lead-screw Feed Mechanism Illustrating Application of Backlash Take-up Shown in Fig. 6

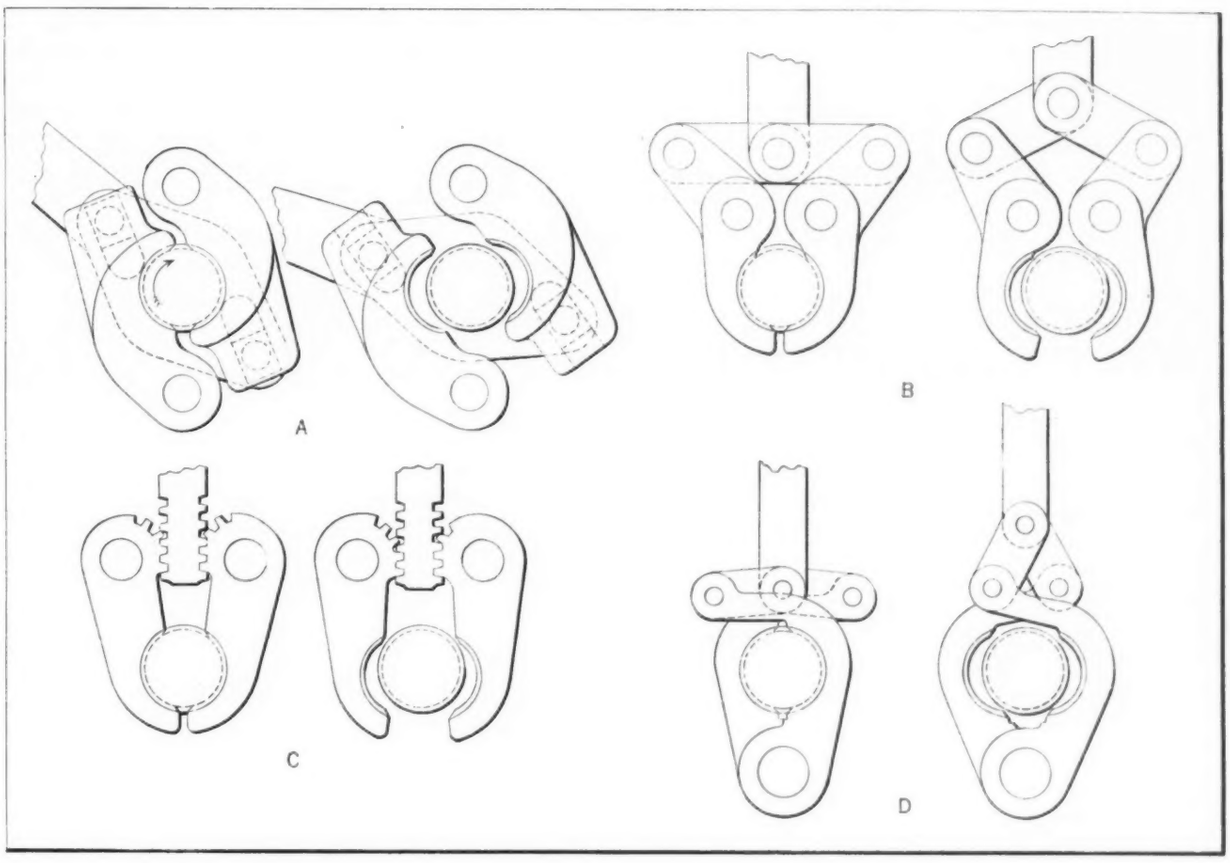


Fig. 9. Diagrams Showing Open and Closed Positions of Four Different Arrangements for Engaging Half-nuts with Lead-screws

with two shafts, in which the operating handle acts directly upon the jaws themselves through sliding blocks. This method is advantageous when it is necessary to have the operating handle on either end of the nut mechanism. It should be noted that in this case the lead-screw should always revolve in the direction shown by the arrow, so that the drag of the screw will tend to keep the mechanism closed.

At *B* is shown a design in which each half of the mechanism is supported by its own shaft and both shafts are above the lead-screw. This is desirable when the clearance under the lead-screw must be held to a minimum. The unit as a whole does not tend to rotate. At *C* is shown an alternate means of operating a mechanism of this type. Sometimes it is necessary to keep the clearance above the lead-screw unit to a minimum. To accomplish this, the pivot shaft is placed below the jaws, as shown at *D*.

Improved Form for Lead-Screw Thread

Most lead-screws are made with the conventional Acme thread form. With this thread form, it is difficult to engage the nut mechanism and the lead-screw without a dial indicator. It has been found by experience and by the actual examination of numerous lead-screw nuts in service that the bronze half-nuts will be worn off, as shown at *A* in Fig. 7.

This wear or damage is caused when the operator endeavors to engage the screw before the crest of the thread in the nut is exactly over the groove of the thread on the lead-screw. Because the lead-screw is of a harder material and has sharp corners at its crests it damages the nut as shown. This materially reduces the effective bearing surface and the life of the nut. To remedy this condition, a special thread form was developed, as shown in the top view. This thread was developed from a standard Acme thread, a circular section being added to the crests of the threads on both the nut and the lead-screw.

The two lower views show the new and the old forms of thread about to be engaged. The threads are both of the same pitch and are out of time with the lead-screw by the same amount. In the case of the standard Acme thread form, shown in the bottom view, engagement cannot be made, and if the operator forces the nut inward, it will damage the thread as explained. But in the case of the round-crested threads the two rounded surfaces are in contact, as shown in the middle view, and as the nut is pushed inward it will slide into mesh with the lead-screw. Even though the rounded crest of the nut were to become damaged, it would not reduce the bearing surface when the nut was engaged, because the crests are in the clearance portion of the thread form.

It is easy to see that, in the case of the Acme thread, the distance C represents the amount by which the nut may be out of time with the screw and still engage, while in the case of the round-crest thread, the distance C is much greater. This allows a much better chance of engagement and at the same time protects the thread against damage. However, when only a single half-nut engages the lead-screw, the flat-top thread might be preferable, on account of the larger bearing surface that it would provide for the supporting bearings at each side of the half-nut. In such cases, the rounded tops would only provide line support, which might not be sufficient.

Steel Castings in Welded Structures

Abstract of a Paper Pointing out the Broad Possibilities of the Use of Steel Castings in Conjunction with Welded Construction. Read Before a Joint Meeting of the American Welding Society and the Metropolitan Section of the American Society of Mechanical Engineers

By R. H. LONGBOTTOM
Dodge Steel Co., Philadelphia, Pa.

THE progress made in the use of welding during the last few years for structures of considerable complexity has led the producer of composite welded structures to avail himself of the established ability of the steel founder to produce intricate pieces that would be unduly expensive to fabricate from rolled bars, plates, and structural shapes. These castings are then used in conjunction with welded designs. Thus we find modern practice embodying the use of large individual plain pieces of rolled steel as the major part of the construction, with the more intricate units of the assembly produced as steel castings of a composition particularly suited to maintain the desired physical properties of the completed structure. Welding and steel casting thus have become complementary processes, and as time goes on, these apparently opposed arts may achieve results at present economically unobtainable by either process separately.

Cooperation Between Designer, Patternmaker, and Founder is Highly Important

The use of steel castings as components of welded structures imposes a particular responsibility upon the steel founder. In most cases, any machining on a weld-fabricated structure has to be done after the piece is fully assembled and has been heat-treated; therefore, if steel castings are components of the structure, it is essential that such castings be commercially sound and free from internal and hidden defects, such as would impair either the appearance or the service properties of the whole assembly.

The production of sound steel castings is to some extent related to design, and much has already been written concerning the necessity for cooperation between the designer and the founder. Inevitably there must be, in some instances, details of design that impose considerable difficulties upon the founder, but cooperation of the designer with the founder frequently results in a lessening of the severity of the metallurgical hazards imposed on the founder by the designer.

The sudden joining of light with heavy sections, the imposition of heavy pads and bosses on relatively light ribs or plates, the incidence of acutely re-entrant angles, whereby comparatively thin masses of sand are subject to extreme thermal attack by cast metal, all tend to promote conditions harmful to the serviceability of the casting.

The cooperation of producer and consumer of castings should, however, go farther than the elimination of the outstanding deficiencies just cited. The founder should preferably be consulted while the design is in the "sketch" stage, in order that a metallurgical monstrosity be avoided, but the founder should also be consulted when the making of the pattern is planned, so that the casting may be placed in the mold in such a manner as to permit adequate feeding of all parts, in order to produce a sound casting.

When castings are to be used as parts of welded structures there is an added necessity for collaboration. To the council of designer and founder must be added the welding technician, who will not only prescribe such elements of design as define the mass and the dimensions of the cast parts in relation to the mechanically worked steel that will form the

bulk of the structure, but will specify fairly closely the chemical composition of the cast metal in order to produce the desired accord of physical characteristics in the completed fabrication.

Composition of Steel Castings Used in Conjunction with Welded Structures

The advocated range of chemical composition in straight carbon steel for castings to be used as units in a welded structure is: Carbon, 0.17 to 0.25 per cent; manganese, 0.50 to 0.80 per cent; silicon, 0.25 to 0.40 per cent; phosphorus, 0.06 per cent, maximum; and sulphur 0.06 per cent, maximum.

Experience has shown that castings of the foregoing range of composition can be successfully welded to steel plates and shapes. This rolled steel is generally of lower carbon, manganese, and silicon contents than those specified for cast steel, but it must be remembered that, as a result of mechanical refinement of grain size, the rolled steel has higher physical properties than a cast structure of identical chemical composition.

The composition mentioned as most suitable for steel castings of the plain carbon type for assembly in welded structures agrees closely with the composition range of the "regular carbon" castings supplied for general engineering purposes.

Heat-Treatment of Welded Structure

The integration of castings in welded structures results in a marked modification of the physical properties of the metal—both cast and wrought—closely adjacent to the weld, and a local heat-treatment of the welded area is reported by competent authorities to be of dubious value. The approved practice is to subject the complete fabrication to a suitable heat-treatment.

Such treatment may be a full annealing at from 1600 to 1650 degrees F. or straight normalizing from a similar temperature, or it may be a simple strain-relieving "draw" at from 1200 to 1250 degrees F. A more complete treatment consists of normalizing and drawing. The nature of the heat-treatment depends upon the materials used, and is governed by the shape, size, and duty requirements of the welded structure. The higher-temperature heat-treatments present the disadvantage of liability to the formation of scale, and it should be remembered that many light-section, weld-fabricated structures will not stand the higher temperatures.

Castings that are intended to become parts of welded structures customarily receive a heat-treatment before they are delivered to the welder, but it is an advantage to the founder to know precisely what final heat-treatment is devised by the fabricator of the welded assembly.

Plain carbon-steel castings of the chemical composition mentioned as suitable for use in connection with welded structures, when properly heat-treated, may be expected to have the following physical properties: Yield point, from 30,000 to 45,000 pounds per square inch; tensile strength, 60,000 to 75,000 pounds per square inch; elongation in 2 inches, 35 to 22 per cent; reduction in area, 55 to 30 per cent; and Brinell hardness, 115 to 160.

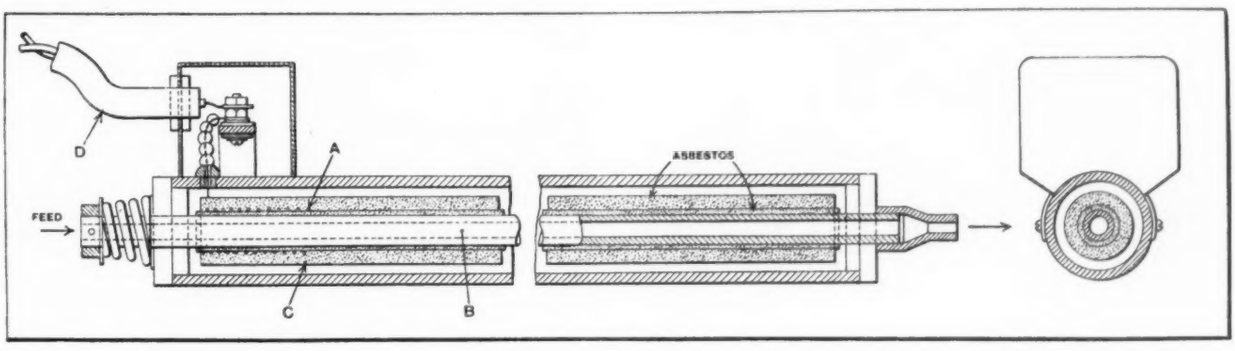
Experiments are now being carried on in the steel castings industry with the object of producing castings that will have increased strength without impairing the weldability of the metal.

* * *

Electric Attachment for Annealing Metal Strip as it is Fed to the Die

Annealing a metal wire or strip as it is fed into a die may be accomplished by means of the device shown in the illustration. In principle, this is an electric furnace having a working temperature of from 550 to 750 degrees F. The device is attached to one side of the press, and consists primarily of a number of turns of resistance wire *A*, wound on an asbestos-covered tube *B*. Through this tube the wire is fed to the die from a reel at the left.

As indicated at *C*, about 1/4 inch of asbestos covers the wire wound on the tube, and the whole is enclosed in a case made from a length of 1 1/2-inch iron pipe. Detachable nozzles are provided on the die end of the device for guiding either round or flat strips. The terminals are connected to a length of three-wire cable provided with a three-pin plug, so that the device may be grounded. This cable, in turn, is enclosed in the flexible metallic tube *D*.



Electrically Heated Device by Means of which Metal Strip is Annealed just before Entering the Die

Roll-Welding High-Pressure Steam Pipe

By GEORGE H. HALL

IN the steam piping system recently installed by the General Electric Co. for carrying steam from their new mercury-steam-electric generating station to distributing points, electric welding was used throughout in the fabrication and erection of the pipe to insure a safe job for those in charge of operation and to minimize maintenance. The entire installation involved approximately 4800 feet of 14-inch steam pipe, 4400 feet of 8-, 10-, and 14-inch condensate returns, and over 3700 feet of tunnel and overhead bridge structure. Steam will be delivered by this system at 400 pounds per square inch pressure, the temperature being 750 degrees F.

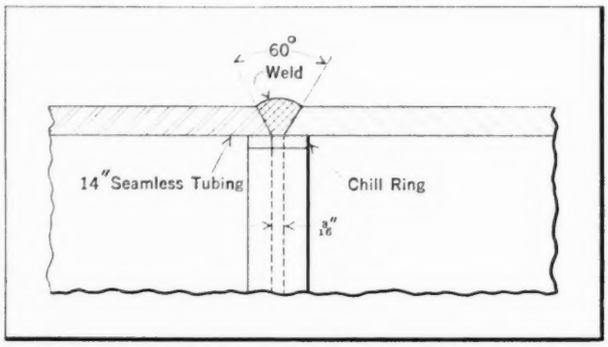


Fig. 1. Section of Roll-welded Joint of High-pressure Steam Pipe

The lay-out of the installation was such that some of the long sections of the 14-inch steam pipe permitted the employment of the roll-welding process, which presented a very interesting as well as practical application of electric welding to large pipe work. This pipe, which is 14 inches in diameter and of seamless construction, has a wall thickness of 1/2 inch and was delivered in 35-foot lengths. The ends of each length were mill-beveled to provide an included angle of 60 degrees at the joint.

For welding a run of pipe, six or seven lengths were placed end to end with a space of 3/16 inch between them. Each joint was backed by a 1/8-inch by 1-inch steel chill ring, tack-welded at several points on the outgoing end of each pipe. This method of assembly is shown in Fig. 1. After the entire run had been assembled on dollies, to permit rotating, the sections were tack-welded together and the actual welding of the joints performed.

For rotating the pipe during this process, a gear was clamped to the pipe and this was chain-driven, through gear reduction, as shown in Fig. 2. While the welding was taking place, the peripheral speed of the pipe was from 6 to 10 inches per minute, depending upon the width of that part of the groove being worked upon. Five passes, involving five rotations of the pipe, were made at each joint. The first pass, depositing the welding metal at the bot-

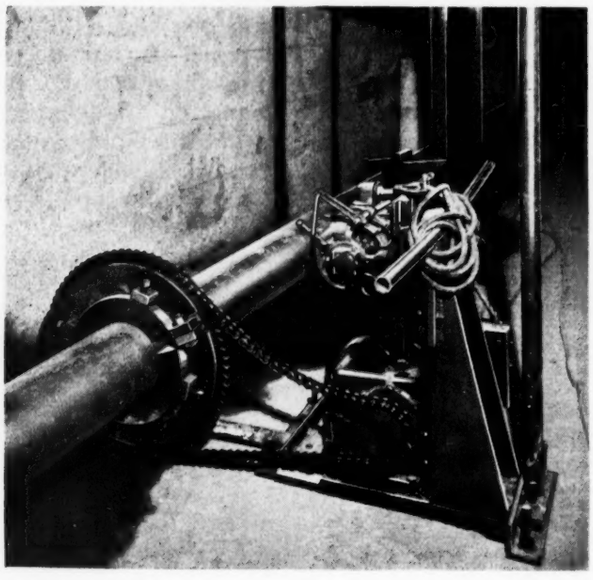


Fig. 2. Method of Rotating a 14-inch Steam Pipe when Welding

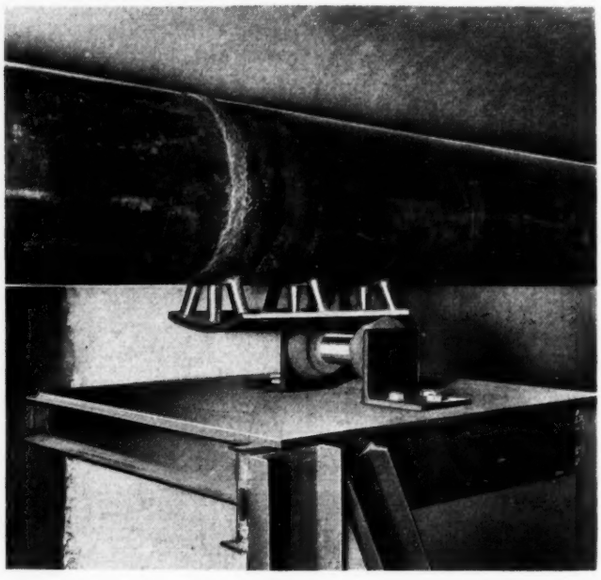


Fig. 3. View of High-pressure Steam Pipe, Showing Welded Joint

tom of the slot, was laid straight with a 3/16-inch coated electrode. The following passes were made with 1/4-inch electrodes, also coated, which were oscillated as required to fill the groove. The final pass was approximately 3/4 inch wide and slightly crowned. The slag formation above the weld was thoroughly cleaned off after each pass.

The completed weld is shown in Fig. 3. It is interesting to note that when test specimens were subjected to tensile tests, the fracture invariably occurred well outside of the weld. The average time required per weld, when the rolling process could be employed, was 1 3/4 hours, as against 3 1/2 to 4 hours on sections that did not permit rolling.

* * *

Two-Way Radio Conversation from Police Cars

In December MACHINERY, page 216, under the heading "Radio Conversation from Moving Automobile," it was stated that Boston was the first city in the United States in which policemen in radio cars could carry on a two-way conversation with headquarters. Commenting upon this, Howard H. Hughes of Springfield, Ohio, writes us that Springfield has had two-way radio cars in operation in its police department for eight months. The city has fourteen cars so equipped, not counting the installations in the cars of the chief and assistant chief of the fire department. These cars are not only able to carry on conversations with headquarters, but any car can call any other cruising car and carry on a two-way conversation. This system was installed by the Radio Engineering Laboratories of New York and is said to be the seventeenth installation put in operation by that company; several smaller cities are taking advantage of this means for protecting their citizens.

* * *

Prospects in the Machine Tool Industry

According to C. J. Stilwell, president of the National Machine Tool Builders' Association and vice-president of the Warner & Swasey Co., Cleveland, Ohio, 1935 will show further substantial improvement in the machine tool industry. It will be a year of steady flow of small- and medium-sized orders arising from immediate replacement needs. Furthermore, there will be some large replacement and repair projects hitherto delayed because of financial considerations. There is also evidence that a growing machine tool demand may be expected from foreign countries, particularly from those where business recovery is definitely under way, such as Great Britain and the Scandinavian countries. Japan is also expected to be a fairly substantial customer. Exports of machine tools were much larger in 1934 than in 1933, and this trend will probably continue.

Sensitiveness of Anti-Friction Bearings

The Timken Roller Bearing Co., Canton, Ohio, sends us the following account of a recent experience which doubtless will prove of interest to the mechanical field generally:

"Recently, a machine tool manufacturer who is particular about the precision of his work reported difficulty in maintaining settings. He had Timken bearings on his work-spindle, and called on that company to analyze and correct his difficulty. It was unusual, and a Timken man went out to check over the situation with the manufacturer's chief inspector.

"The inspector said, and demonstrated, that when he tapped the spindle lightly with a lead hammer to center the work in the chuck, the setting changed. The indicator gage was mounted on a very heavy casting not connected with the machine. Checking the bearing failed to indicate any possible source of difficulty.

"Even though the machine that was giving trouble weighed nearly 3000 pounds, the Timken representative had the inspector tap the base of the machine just as he had tapped the spindle. It seemed ridiculous, but the indicator showed the same result. Several trials proved that, so delicate was the indicator and so accurate the spindle setting, even a light tap on the machine itself was sufficient to disturb the setting of the whole machine.

"When the machine was firmly fastened to the floor, even though it seemed too massive to require anchoring, the trouble disappeared. Wedges alone used to line up a heavy machine are not always sufficient, and this unusual incident serves as an example of the importance of investigating even remote possibilities when unexpected manufacturing difficulties seem to be developing."

* * *

Where New Equipment is Needed

It has been estimated that the Government navy yards and arsenals have machine tools and shop equipment to an original value of between $35,000,000 and $40,000,000, the average age of which is twenty-eight years. Here it would appear that there is an opportunity for rehabilitation of industrial equipment and a place where the Government might spend some of the billions appropriated for recovery purposes to real advantage.

The navy yards and arsenals certainly must need better equipment than they have, if the average age of their present machinery is nearly thirty years; and the machinery builders could provide much needed re-employment in productive work if relief money were used for such replacement purposes. Groups of impartial engineers could be employed to make surveys as to what equipment actually ought to be bought for replacement.

Engineering News Flashes

The World Over

Bricks that Float

A new industry has been started in West Lothian in Scotland. Bricks are being made of what was formerly thought of as a waste material—spent shale. A process has been developed through which bricks of any shape or color can be made from this waste material. These bricks may, if required, be made so light that they will float in water and so soft that they can be cut by saws as easily as timber; yet they are strong enough to be used for building purposes.

The Electric Eye Now Wears Blue Glasses

As a result of a severe code requirement, the paper industry has been forced to find a means of classifying different qualities of paper. It was determined in the General Electric Engineering Laboratory that, so far as white book papers are concerned, the reflection of light thrown upon them is an indication of their quality. Having ascertained this, the research men built an instrument that relied on the scrutiny of two electric eyes in series to measure the "coefficient of reflection," an exceedingly delicate task. To do the job right, however, the electric eye had to be provided with a dark blue glass in the form of a filter and lens arrangement. With this equipment, it has been found possible to determine the quality of paper with very small percentages of differentiation.

Long-Distance Soviet Power Transmission

The power transmission line to Leningrad from the Svir hydro-electric power plant is 150 miles long and carries current at 220,000 volts. The Svir station will have an ultimate capacity of nearly 100,000 kilowatts, and is expected to be completely in operation shortly. All of the equipment has been built in the Soviet Union.

Oil Power Makes Inroads on Steam

Frequent references have been made to the inroad of the oil engine on the steam engine for ship propulsion. The following figures from *Lloyd's Register* on the state of shipbuilding on September 30, 1934, give further evidence of this fact. On that date, there were 45 motor ships and 80 steam ships under construction in British shipyards. In the entire world's shipbuilding on that date, there were under construction ships with 730,000-horsepower oil engines, 616,000-horsepower steam turbines, and 123,000-horsepower reciprocating steam engines. In other words, in actual power provided, the oil engines almost equalled the total steam power.

World's Most Powerful Electric Locomotives

The fifty-seven streamline electric locomotives recently ordered by the Pennsylvania Railroad for its New York-Washington service, will be the world's most powerful electric passenger locomotives. These locomotives will make possible a regular operating speed of 90 miles an hour, hauling trains of regular size and length. They have twelve 57-inch driving wheels, six on each side. The horsepower developed by the motors will be 4620. The locomotives are approximately 80 feet long, of all-steel construction, and weigh 460,000 pounds. They will cost in the neighborhood of $250,000 each.

New Textile Machinery Improves Production Economy

In spite of the high perfection of spinning machinery, substantial economies in production costs are obtained through new spinning equipment built by the Casablanca's High Draft Co., Manchester, England. The new machine, known as a "compound drafting machine," is the result of research carried out under actual mill conditions over a period of years. The machine eliminates some three or four processes through which the cotton passes in existing practice, at the spinning frames. Apart from higher output and savings in costs, tests show that the new machines produce a better quality of yarn.

Grinding Operation of Extreme Delicacy

Delicate and accurate grinding operations are not confined to the grinding of metal parts. A machine built by the Curtin-Herbert Co., Gloversville,

N. Y., for shaving or grinding the tanned hides for glove manufacture to a uniform thickness, performs a grinding operation of the utmost accuracy. This operation consists of passing the hide under a rapidly revolving abrasive roll which grinds off the surface and reduces the thickness as required. Extreme accuracy is necessary, because the least wabble in the grinding roll would ruin the skin. The operation is so accurate and the adjustment of the grinding roll so delicate that a piece of newspaper or magazine page may be passed under the roll and only the print will be removed without cutting through or tearing the paper. The machine that does this work has a grinding roll 50 inches long, mounted on Timken roller bearings and direct-connected to a five-horsepower motor which revolves at a speed of 1150 revolutions a minute.

Largest Gears Made in Great Britain

Two large gears, both of the double-helical type, were recently completed by British engineering firms. One of these gears is believed to be the largest ever made in England. Its diameter is 19 feet; it has a face width of 4 feet 2 inches, and has 222 teeth. The gear transmits 16,000 horsepower at 28 revolutions per minute in an Australian rolling mill.

The second gear is believed to be the largest gear of its kind ever cast in one piece. It weighs over 24 tons finished, and has nine pairs of arms of channel section. The 203 double-helical teeth were machined from the solid. The face width is 40 inches, and the diameter, 13 feet 7 1/2 inches. This gear is also intended for a rolling mill drive, transmitting loads of about 10,800 horsepower.

Tantalum Sheets 0.005 Inch Thick Electrically Welded

Tantalum sheets worth $50 a pound and only 0.005 inch thick are now being arc-welded regularly in the fabrication of chemical equipment. Tantalum possesses characteristics that make it valuable for use in many types of laboratory accessories, since it is not tarnished by air nor attacked by acids, with the exception of hydrochloric acid. Fansteel Products, Inc., Chicago, Ill., one of the largest suppliers of tantalum, is the company that has developed the method for welding this metal, using equipment made by the Lincoln Electric Co. The welding is actually accomplished by melting the edges of the thin sheets of the flanges welded together. It is obvious that the welding must be accomplished very quickly.

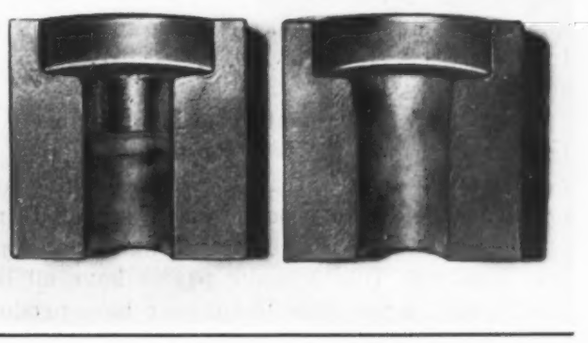
Soviet Diesel Motor for Airplanes

An experimental high-powered Diesel engine for airplanes was recently constructed in Moscow. Tests made with the engine have shown favorable results; less fuel, by weight, is consumed per hour per horsepower, as compared with gasoline engines.

Another Advance in Aluminum-Alloy Pistons

The latest step in the evolution of the aluminum-alloy piston for motor vehicles is "Alumiliting," a process that forms a hard, smooth aluminum oxide surface as an integral part of the piston. This surface has exceptional bearing qualities and materially increases the resistance of the piston to wear. The life of the piston thus treated is substantially lengthened, and the wear on the cylinder walls is also reduced.

This process, developed by the Aluminum Co. of America, consists in electrolytically treating aluminum pistons by a process similar to that used for electroplating. The machining and grinding of the pistons are completed before treatment, as the thickness of the Alumilite finish can be controlled uniformly within very close limits. The oxide surface formed is created out of the metal itself and is not a layer of material deposited on the surface. This accounts for the tenacity with which it adheres to the piston surface and explains why there is little change in diameter due to the treating process. The Alumilite finish has the hardness and smoothness of a fine bearing surface.



The view at the left shows a hot-forging die hard-faced with a non-ferrous cobalt-chromium-tungsten alloy. The die is still straight after completing 18,000 forgings. The plain steel die on the right is considerably bell-mouthed and unsuitable for further service after the completion of 7000 forgings. Expansion due to heat and subsequent contraction have checked the surface of the hard-faced die, but it can be quickly and easily reconditioned by simply melting together the hard-facing deposit and adding some more wear-resistant alloy. After this, a grinding operation completes the job. Photograph, courtesy Haynes-Stellite Co.

EDITORIAL COMMENT

In 108 NRA codes, there are 163 provisions limiting the extension and use of plant capacity and restricting industrial production, according to a report by the Capital Goods Industries Committee of the American Society of Mechanical Engineers. This report is a comprehensive tabular presentation of the code provisions that restrict the use of machinery and limit industrial output. How much these restrictions have hampered American industry during the past year and a half cannot be determined, but many instances of retardation of recovery have been brought to the attention of the members of the committee.

The situation revealed by the report justifies the committee in making this observation: "If restrictions like those presented had prevailed in American industry during the first quarter of this century, much of the industrial progress, and the rise in the standard of living that came therefrom, would never have been enjoyed. It is the opinion of the committee that the continuance of restrictions of this type is not in the public interest, nor conducive to healthy industrial development."

Code Restrictions on Machinery and Production

The tenacity with which Labor, many employers, and the American public in general hold to the erroneous belief that the depression was due largely to too great a production of the goods and services that everybody wants and needs for their well-being and comfort is one of the evidences of the grip that an erroneous belief can get on a nation. There may be an excuse for Labor in so interpreting adverse economic conditions; but the belief has been shared by business men and by the National Recovery Administration. This is the reason that provisions to restrict the installation and use of efficient manufacturing equipment and to limit production have been written into 108 codes.

Years ago an eminent American engineer, the late Henry L. Gantt, foretold the coming of the depression and said that it would be attributed erroneously to "over-production." Said Mr. Gantt:

"Over-production has been the bugbear of American business. Our periodic panics have all been laid to this. From time to time we have produced so many goods that there was no market for them, and the industries have had to shut down. This brought unemployment and poverty, with consequent inability to buy the things we had produced.

Over-Production, the Bogyman that Frightens Us

The workers then had to go ragged because they had produced so many clothes. They had to go barefooted because they had produced so many shoes. They had built so many houses that they had to live outdoors. Can anyone find an excuse for continuing such a system of industry?

"We have never had over-production yet. We have never produced more things than we wanted. All that we have done is to produce more than we could buy. With distribution simplified, the bugbear would be removed."

Mr. Gantt had a most unusual ability to analyze economic and industrial conditions and to separate facts from fallacies. Had industrialists, economists, and labor leaders alike given heed to what he had to tell, we would have been saved many of our present troubles. We would not have written into our industrial codes 163 provisions for limiting the use of efficient machine equipment, restricting production, and lowering the standard of living.

Yet, it is not too late for the Administration, industrialists, and labor leaders to get together and take the right road to recovery. What is required is broadmindedness in admitting an error and willingness to cooperate.

▼ ▼ ▼

"The fact is that these depressions have their source in man himself and in the social maladjustments he himself devised," says *Commerce and Finance*. "If he will but correct these maladjustments by putting things where they belong and devoting them to their proper uses, he will have a properly balanced economy in which the strains are evenly distributed, and he need fear no 'tornado of depression' to blow his 'structure' down from without. The greatest and basic maladjustment is in his disposal of public and private revenues. Populations create their own public revenues by the mere fact of their coming together to live and work in civilized communities."

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Reversing Rotation of Shaft After One Complete Turn

The pin type of mangle gearing mechanism shown in Fig. 1 is designed to reverse the driven shaft after it has made a complete turn. With this mechanism, the driven shaft has a somewhat variable motion. The smaller the lead of the spiral in relation to the distances of the pins from the shaft center, the less will be the velocity variation. Fig. 2 shows one arrangement for driving the pinion shaft *b*, Fig. 1, which provides for the required oscillation of the pinion or sprocket shaft.

It is obvious that an infinite number of velocity combinations are possible by varying the shape of the mangle gear shown in Fig. 1. The continuous groove *G* serves to keep the sprocket in mesh with the pins. The end of the pinion shaft *b* may either rotate directly in contact with the groove or it may bear against the groove side through a ball journal bearing attached to the shaft.

Perhaps the most common method of driving the pinion of a mechanism of this kind is by bevel gears, the bevel gear on the pinion shaft serving as a universal joint. This method has the objection, however, that owing to the oscillation of the shaft, the pinion occupies different angular positions, not only during the oscillation but when it is driving. To allow for the change in the angle, the teeth of the pins must be barrel-shaped. Generally they are permitted to assume this shape through wear. The driving method shown in Fig. 2 is preferable to the bevel gear drive. B. M.

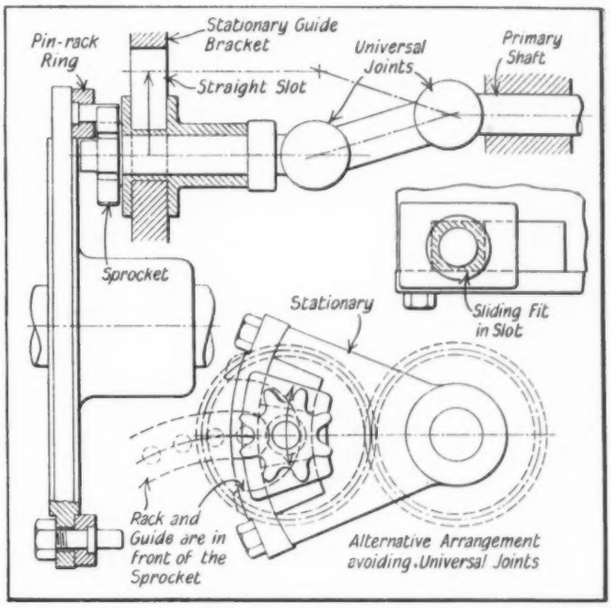


Fig. 2. Types of Drives Arranged to Permit Oscillation of Driving Shafts such as the One Shown at b, Fig. 1

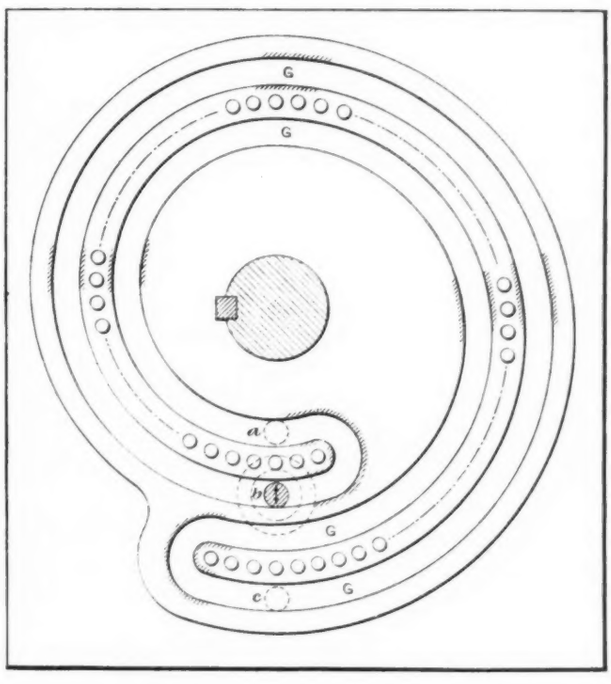


Fig. 1. Pin Type of Mangle Gearing Arranged to Reverse Driven Shaft after One Complete Turn

Mechanism that Causes a Slide to Dwell During Every Other Cycle

By J. E. FENNO

The almost human motions of a certain bread-wrapping machine are produced by employing some very interesting and unusual mechanisms. One mechanism, in particular, which appears to the writer to be of unusual design controls the action of the bread-shifting slide. This slide is operated by another sliding member and dwells during every other cycle of the driving member.

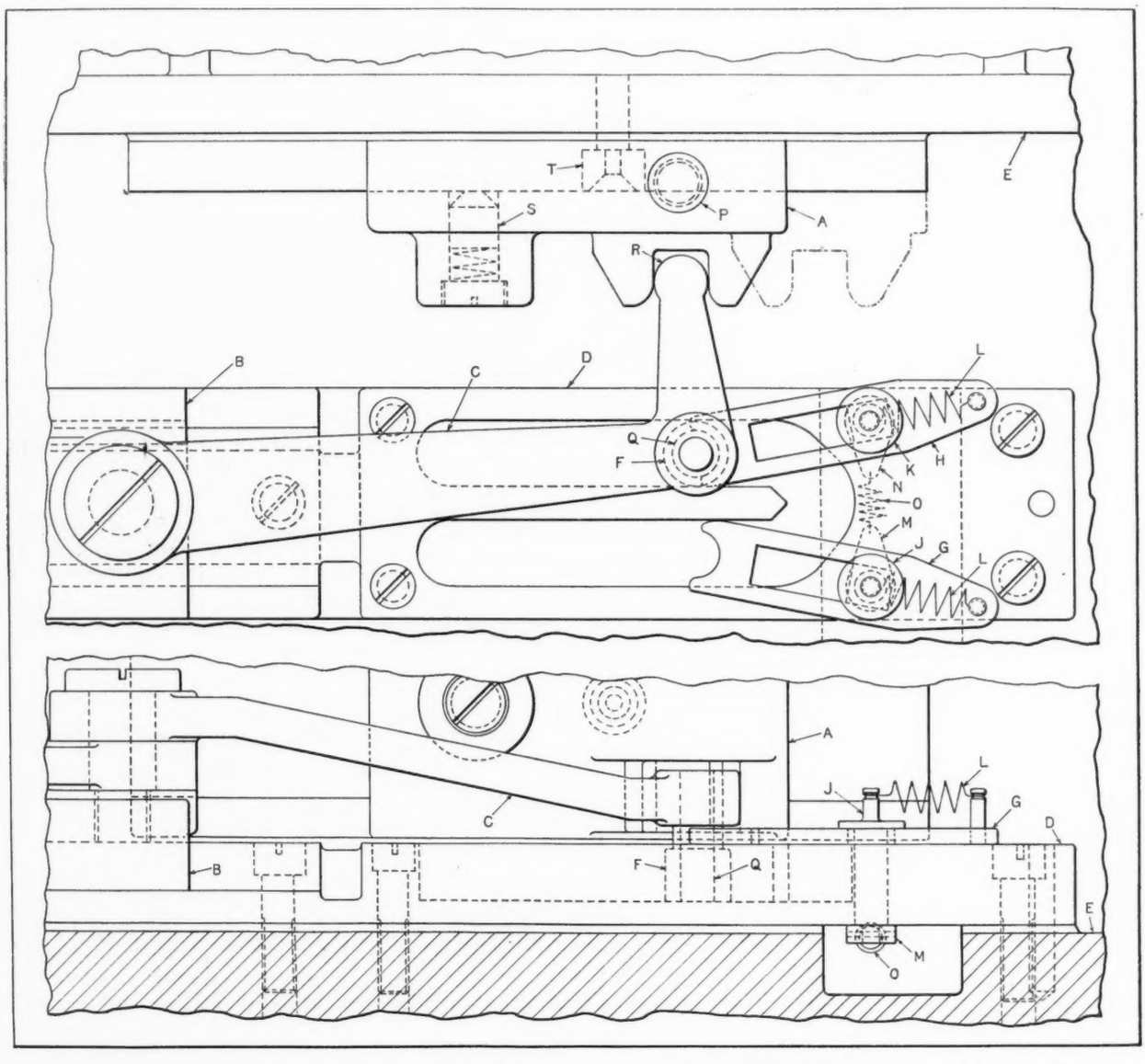
The mechanism for producing this motion is

shown in the accompanying illustration. The bread-shifting slide is indicated at *A*. This slide transmits its controlling motion to the loaf-holding member (not shown) through stud *P*, and is actuated by the continuously reciprocating slide *B* through the connecting-rod *C*. Rod *C* is automatically disengaged from slide *A* after every other cycle of slide *B* by the switching arrangement mounted on the base *D*, which is secured to the machine frame *E*. Thus, base *D* serves also as a guide for the slide *B*. In the top of the base is machined a U-shaped groove with which the roll *F* on the connecting-rod engages.

Two spring-actuated switching arms *G* and *H* are pivoted to the base by the pins *J* and *K*. These pins are free to turn in the base and have a square shoulder near their upper end on which the arms slide. The arms are held normally in the position shown by the coil springs *L*. On the lower ends of the pins are secured fingers *M* and *N*, connected by the coil spring *O*. The tension of spring *O* serves to return the arms to their normal positions.

Slide *B*, together with connecting-rod *C*, moves slide *A* through part of its stroke toward the right. As these members continue their movement in this direction, the roll *F* enters the curved portion of the U-groove, withdrawing the projection *R* on the connecting-rod from its recess in slide *A*. This causes slide *A* to stop. In the meantime, however, the end of arm *H* engages the shoulder on the roll stud *Q* and is forced back toward the right. Thus, when the roll has reached its extreme right-hand position, the energy stored up in spring *L* forces the roll past the dead center. At this point, the slide *B* reverses its motion, and as it moves toward the left, the roll travels in the lower part of the groove.

Obviously, during this stroke of slide *B*, and also during its return stroke, the projection *R* on connecting-rod *C* remains disengaged from slide *A*.



Mechanism Driven by Constantly Oscillating Slide B which Allows Slide A to Dwell During Every Other Oscillation

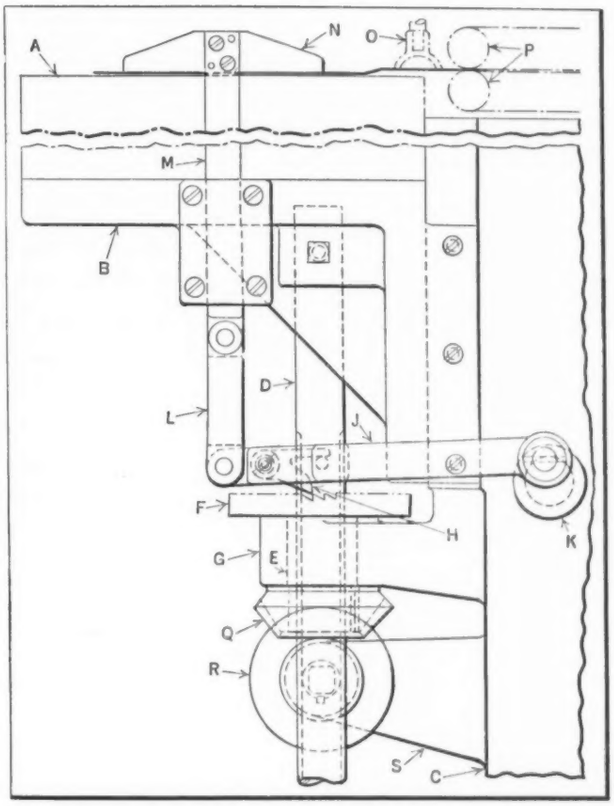
Hence, the latter dwells during this cycle. However, when slide *B* returns, the roll stud *Q* engages arm *G*, so that when the roll reaches its extreme right-hand position in the groove, the arm forces the roll past the dead center and into the opposite section of the groove.

In entering this section of the groove, the projection on the connecting-rod again engages the recess in slide *A*, so that this slide is carried with slide *B* toward the left. It also returns with slide *B* to the position indicated by the dot-and-dash outline. At this point, the connecting-rod projection is again disengaged, as already described. Thus, slide *A* has a dwell equivalent to a complete cycle after every other cycle of the machine.

In order to have slide *A* stop at exactly the same position every time it dwells, the spring-actuated plunger *S* was provided. The end of this plunger merely rides along the top of the guide for slide *A* until the slide reaches its dwelling position. When this occurs, the plunger drops into the depression in the bushing insert *T*, thus locking the slide securely during the idle stroke of slide *B*.

Mechanism for Keeping Top Sheet of Stack in Line with Feed-Rolls

By F. E. JUDSON



Mechanism that Keeps Top Sheet of Stack in Magazine in Line with Feed-rolls

Many types of magazine feeds have been devised for feeding sheets of various thicknesses. However, the feeding of unusually thin sheets from the top of a stack of sheets in a magazine presents a difficult problem to the designer, owing to variations in the gage size, dirt between the sheets, etc. A magazine in which these conditions do not affect the feeding action is shown in the accompanying illustration. It is used successfully for feeding thin sheets to a paper-tube rolling machine and can be readily adapted to the feeding of metal sheets as well. Regardless of variations in thickness, this mechanism automatically keeps the top sheet in line with the feed-rolls.

The rectangular sheets *A* are stacked on the vertical slide *B* mounted on the machine *C*. This slide is given a vertical feeding movement by means of the screw *D* secured to the slide. The screw engages a nut *E* which is an integral part of the ratchet wheel *F*. Bearing *G*, cast on the machine frame, serves as a support for the nut and ratchet wheel. The latter is rotated to feed the screw and slide *B* upward by means of the pawl *H* pivoted to the reciprocating bar *J*. This bar receives its movement through the constantly rotating crank *K*, and at its left-hand end is connected to link *L*. Link *L*, in turn, is connected to the bar *M* which slides in a guide on the slide *B*. At the top of bar *M* is a cross-piece *N*, which rests on the top of the sheets.

As indicated, slide *B* has just been loaded with sheets and the suction cups *O* have raised the end of the top sheet preparatory to carrying it forward and between the moving belts on the rolls *P*. These belts then transfer the sheet to the rolling mechanism. It will be noted that while this top sheet is under the cross-piece *N*, the pawl *H* remains out of engagement with the ratchet wheel; therefore there is no upward feeding movement of slide *B*. However, as soon as the sheet is pulled from under the cross-piece, the latter, together with bar *M*, link *L*, and arm *J*, drops down an amount equal to the thickness of the sheet. This causes pawl *H* to engage the teeth in the ratchet wheel, rotating the latter and feeding screw *D* and slide *B* up until the next sheet is on a level with the preceding one.

Now, as cross-piece *N* travels with the top sheet, arm *J* will once more lift pawl *H* out of engagement with the ratchet wheel and thus stop the feeding action of the screw and slide *B*. These movements are repeated after each sheet is transferred to the machine; and it is obvious that regardless of the variation in the thickness of the sheets, the top sheet will always be at the same level to facilitate its transfer between the rolls *P*.

To permit reloading of the magazine, bevel gears *Q* and *R* are provided. Gear *Q* is keyed to the nut, while gear *R* is keyed to a shaft which turns freely in bracket *S* cast on the machine. The shaft for gear *R* is square at its outer end to accommodate a hand-crank used for moving the slide manually to its loading position. At this time, pawl *H* is swung up out of engagement with the ratchet wheel.

What a Shop Executive Should Know About the Heat-Treatment of Cutting Tools

A Review of the Important Factors that Influence the Selection of Heat-Treating Methods—First of Two Articles

By ROBERT C. DEALE
Executive Secretary, Sub-Committee on Metal Cutting Data, American Society of Mechanical Engineers

WHILE it is generally understood that it is important to use the correct heat-treatment for a particular tool material, it is not always realized just how many factors must be considered in determining upon this heat-treatment. The following points are all of importance, and must be carefully considered:

(1) Tool material. (2) Tool size. (3) Tool shape. (4) Desired transverse or torsional strength. (5) Whether tool is to have cutting edges ground after hardening or not. (6) Type of furnace used. (7) Furnace atmosphere. (8) Preheat temperature. (9) Time required in preheat furnace. (10) Hardening temperature. (11) Time required at hardening temperature. (12) Second heat-treatment or "tempering" temperature. (13) Time at second heat-treatment temperature.

It is understood that there is a considerable difference between the heat-treatment necessary to obtain the best results from carbon steel tools and that which should be used for high-speed steel tools. The differences between the treatments for high-speed steels of varying compositions have been obscured by the fact that manufacturers of steels have quite different ideas as to the treatment that should be used for their particular brand of steel.

This is illustrated by the case of a prominent manufacturer of machine tools, who had had difficulty, not only with the tools used in his shop, but with the special tools that were manufactured in connection with one of the machines in his line.

Requests were sent out to seven of the leading manufacturers of tool steel for their recommendations as to the heat-treatment to use with their particular brands of standard 18-4-1, 14-4-2, and cobalt steels to secure maximum cutting efficiency. This data, when received, was tabulated in such a way that all steels of similar composition were grouped together. It was found that there was no exact agreement between any two sets of recommendations, and some parts of the recommendations differed so widely as to be contradictory. An attempt was made to obtain a single hardening specification for each class of steel through a process of selecting a mode, or mean value, for each temperature and time. These specifications were then sent out for criticism to each of the steel companies concerned. In practically every instance, they desired to make changes.

In spite of this, experimental evidence seems to indicate that all steels of a given class should be given exactly the same heat-treatment if the best results are to be secured. This treatment may vary according to the conditions under which the tool is to be used, but everything available in the literature on the subject indicates that the slight differences in analysis between the steels in a given class, as manufactured by different companies, are not of sufficient importance to require any appreciable change in the heat-treatment.

Frederick W. Taylor, in paragraphs 973-976, in his book "On the Art of Cutting Metals," describes experiments that he made to determine this point. A number of samples of tool steel were obtained from the leading manufacturers in the United States, England, and Germany, together with the recommendations of the manufacturer as to the heat-treatment that should be used with his steel. In his own words:

"Without an exception, the same make of tools, when treated in exact accordance with the directions given in our patent (the Taylor-White patent), proved more uniform and ran at slightly higher cutting speeds than when treated in accordance with the directions given by the makers."

It is believed by the author that the same situation still holds, and that the variation in recommended heat-treatments is caused largely by the lack of authoritative experimental data. The Subcommittee on Metal Cutting Data of the American Society of Mechanical Engineers has taken steps to fill this gap, but will probably be unable to obtain satisfactory data for at least a year because of the complexity of the necessary investigation. At the present time, the only important differences in heat-treatment appear to be required when the steels are of appreciably different analyses as the 18-4-1 and 14-4-2 types, and the same steels with cobalt added in different proportions. There is no available data as to the hardening of the high-vanadium steels.

The shape of a tool naturally has an influence on the details of the heat-treatment. A tap or die in which relatively small teeth do the cutting obviously does not require as deep hardening as a lathe

tool, which can be ground down as long as it has sufficient mechanical strength to stand up under the cut. In such a case, the depth of hardening need only be sufficient to penetrate the teeth, leaving a tougher core to withstand torsional strains.

When the cutting edge of the tool is well supported and when the tool size is quite large relative to the size of the chip, the tool may be treated to secure maximum cutting efficiency. When a tool is to be used under conditions involving considerable shock, a treatment must be used that gives greater toughness, even though cutting efficiency is thereby sacrificed. This is usually accomplished by increasing the tempering temperature from 30 to 50 degrees F., and also increasing the time that the tool is held at this temperature to four or five hours.

The data as to the effect of the secondary heat-treatment seems to be rather contradictory, and at the present time it is not known just what treatment gives the best results. One set of experimental data seems to indicate that a tempering temperature of from 1060 to 1100 degrees F. should be used when maximum cutting efficiency is desired, and a temperature of 900 degrees F. when maximum resistance to shock is necessary.

When tools are to be ground after hardening, a certain amount of scaling of the surface causes little difficulty, as the scale is ground off before the tool is used. When a tool is formed before hardening, as is the case with formed milling cutters, taps, and dies, extreme care must be taken to keep the surface and the cutting edges as perfect as possible. This is frequently accomplished through the use of lower hardening temperatures, at the expense of cutting efficiency.

Furnaces for Heat-Treating Cutting Tools

The furnaces used in the hardening of high-speed steel fall into three general classes, as follows: (1) Gas- or oil-fired box furnaces. (2) Resistor type electric box furnaces. (3) Fuel-fired or electrically heated pot type furnaces.

The furnaces used in the majority of the machine shops and the commercial hardening shops of the country are in the first class. Such furnaces should have independent control of fuel and air, so that both temperature and atmosphere can be controlled. A good thermo-couple should be provided, so that the heat-treater may know exactly what the furnace temperature is. While it is possible to control furnace temperatures without the use of thermo-couples, through the use of standard test blocks of high-speed steel, it is believed that it is far preferable to know the exact temperature, using the test blocks to check the pyrometer if desired. These blocks are usually of about 3/4-inch square section, and the furnace temperature is so adjusted as to bring the block to a semi-plastic condition in a predetermined time.

It is believed that a fully automatic temperature control for the furnace will more than pay for itself by the greater uniformity of the tools hardened in it. Extreme care must be used in placing the thermo-couple so that it will accurately measure the temperature of the tool rather than of some relatively unimportant part of the furnace.

While doors are frequently provided for such furnaces, it is desirable to operate them with open doors to avoid the drop in furnace temperature caused by an inrush of air when the door is opened. Under ordinary circumstances, the furnace losses are not likely to be increased greatly by operating in this way. Another important point is to have the hearth so arranged that heat is applied beneath it as well as above, and to have a hearth that transmits heat freely, so that the tool can be heated uniformly.

Characteristics of Box Type Furnaces

With a box type furnace, the heat may be supplied by the combustion of oil or gas, or by electrical resistance elements. When oil or gas is used, it is desirable to use a furnace of the full muffle type, in order to prevent contact of the products of combustion with the heated tool material. It is almost impossible to control accurately both the temperature of the flame and the furnace atmosphere when combustion takes place in the heating chamber. At temperatures between 2300 and 2500 degrees F., the temperature range at which the hardening of high-speed steel is usually carried out, both steel and furnace gases are very active chemically, so that it is necessary to exercise extreme care to prevent interaction. It is much better, where possible, to use a hardening furnace in which all heating is by radiation. Fuel-fired furnaces of the full muffle type are built, in which control of the atmosphere is secured through a supplemental burner, the sole purpose of which is to control the furnace-gas composition accurately.

Furnaces heated by electric resistors, while giving a very uniform heating through radiation, may invite some difficulties because of the behavior of the resistance elements at the high temperatures required. Elements that have proved to be practical for such use are silicon carbide, or "globar," and graphite. The graphite resistors have been used only for small furnaces. The silicon carbide resistors change their resistance during their operating life, so that an arrangement must be made for varying the voltage impressed on the resistors from time to time, in order to keep the power input to the furnace relatively constant. The resistors are somewhat brittle and must be carefully handled to prevent breakage. It is understood that metallic coatings on the ends of the resistance elements, combined with water-cooled terminal connections, produce a considerable improvement in operating conditions.

Pot type hardening furnaces eliminate the difficulties caused by variations in the furnace atmosphere encountered in the box type furnaces, but

have difficulties peculiar to themselves, such as pot failure, breakdown of the bath material, and adhesion of the bath material to the tool. They have proved to be particularly satisfactory for the lower temperatures, but are not yet sufficiently developed to supplant to any extent furnaces of the box type when temperatures above 2300 degrees F. are necessary. Both lead baths and various combinations of non-metallic salts have been used. The best practice seems to be to use these furnaces for preheating and tempering of high-speed steel tools and hardening of carbon steel tools.

It is understood that pots have a short life when used at the higher temperatures. One case has been brought to the attention of the author in which it was found desirable to replace pots every day to prevent any possibility of failure during operation. In this instance, it was more economical to use cheap boiler steel pots, which were frequently replaced, than to use pots made of special heat-resisting metal, which, while they would have a longer life, were appreciably more expensive.

The difficulties encountered with furnaces of this type are apparently caused by the necessity of transmitting heat through the pot into the bath at temperatures close to the melting point of steel. To insure that the bath is kept at a temperature of 2400 degrees F., it is necessary to maintain a temperature of at least from 2600 to 2800 degrees F. on the outside of the pot, with the result that it not only oxidizes, but tends to lose strength through grain growth. If the heat could be generated in the bath, so that the pot could be kept relatively cool, the operation would be more satisfactory.

The second and final installment of this article, which will be published in the March number, will deal with controlling the furnace atmospheres, preheating temperatures, heating to the hardening temperature, standardizing heating periods, and the tempering of high-speed steel tools.

How to Provide Better Lighting in Machine Shops

Commenting upon the various articles on machine shop lighting that have appeared recently in MACHINERY, J. J. McLaughlin of the Westinghouse Lamp Co. says that lighting engineers have been greatly hampered in the past by the reluctance of manufacturers to spend enough money for really good lighting; hence the lighting engineer has had to content himself with recommending an amount of lighting that he knew full well would hardly satisfy the needs of the human eye.

A committee of lighting authorities several years ago concluded that the human eye, to function efficiently and safely, required not less than 300 foot-candles. Unfortunately, the industrial pocketbook does not permit 300 foot-candles to be provided in the form of general illumination.

In local lighting, therefore, lies the most practical way of obtaining the high intensities necessary. But local lighting, or illumination individually applied, cannot be installed as carelessly as it has been in the past—that is, with the haphazard use of drop cords and bare lamps; nor should such lighting be the only illumination in the work area. Local lighting should be used only as a supplement to general illumination of jobs that require close vision over long periods, such as inspection work and machine operation.

Obviously, local lighting must have the light source close to the working surface; yet, to comply with this feature alone does not solve the problem. The lamp itself must be of sufficient wattage. This, in turn, depends upon the proximity of the light source to the work. Sometimes it is not possible, because of the working conditions, to bring the lamp as close to the work as is desirable. Experience shows that with the light source 10 inches from the work, an intensity of from 30 to 225 foot-candles can be obtained with proper reflectors.

If a large enough lamp is used, it will provide ample intensity, even though it is not equipped with a reflector; but the resultant glare from a bare lamp will defeat the original purpose of providing good lighting. Therefore, every local light should be protected with a reflector. Furthermore, in this way, the illumination is considerably increased, because the light otherwise wasted is utilized.

Generally speaking, when using mill-type reflectors, the following kinds of reflectors should be used for the given wattages: 15 watts, small reflector; 25 to 50 watts, medium reflector; 50 to 60 watts, large reflector.

The lights must have proper attention. The accumulation of dirt and grease on lamps and reflectors and the use of old lamps that have passed beyond the efficient period of their life, soon reduce the value of the light source. In one instance it was found that by cleaning the reflector and installing a new lamp the intensity was increased 50 per cent. Better shop lighting can often be obtained just as simply as that.

* * *

The principles of applied mechanics, being expressed in tangible form and readily visualized, are far easier to grasp and apply than are the subtle and less self-evident principles of economics. Because of this fact, men are likely to substitute personal opinions for these principles. No opinion is better than the information of the man who expresses it.—*Robert Scudder Denham*

Lathe for Producing Microscopic Laps and Dies

A Special Lathe with Air-Driven Spindle Operating at a Speed of 65,000 Revolutions per Minute, Is Used in Machining Delicate Laps One-Tenth the Diameter of an Ordinary Pin Head

By STEN WADSTEN, Westinghouse Lamp Co.

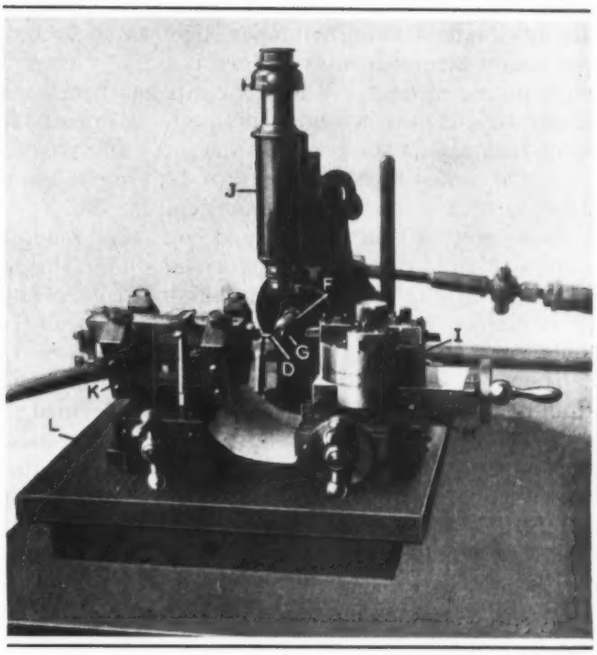


Fig. 1. Lathe Equipped with Microscope and Attachments for Making Laps and for Lapping Dies of Microscopic Proportions

A NEW method of coiling the tungsten filaments of Westinghouse Mazda lamps was found necessary in order to enable the lamps to pass the critical inspection given this product. One of the most difficult problems connected with this work is the maintenance of strictly uniform quality. To meet this requirement, the Westinghouse Lamp Co. has developed a non-stretch mandrel-less filament coiling machine, in which a diamond coiling die is used. A special lathe was designed to machine the laps of microscopic proportions used in making and conditioning the diamond coiling die. Because of the shape and minute proportions of this lap, a very high degree of skill is necessary in setting and sharpening the tools.

The microscopic lathe job described here concerns the making of the die for the mandrel-less coiling machine. The tungsten filament wire of an electric lamp is coiled by driving the wire, as shown at *C*, Fig. 2, endwise into the cavity in die *D*. The driving force is applied to the wire by rolls as shown. This produces a succession of coils or convolutions, as may be seen by the front view of the die at *E*. The coils are forced over a lip or spreader on the die, which spaces the turns of the coil as it leaves the die cavity so that the finished coil has a predetermined number of turns per inch.

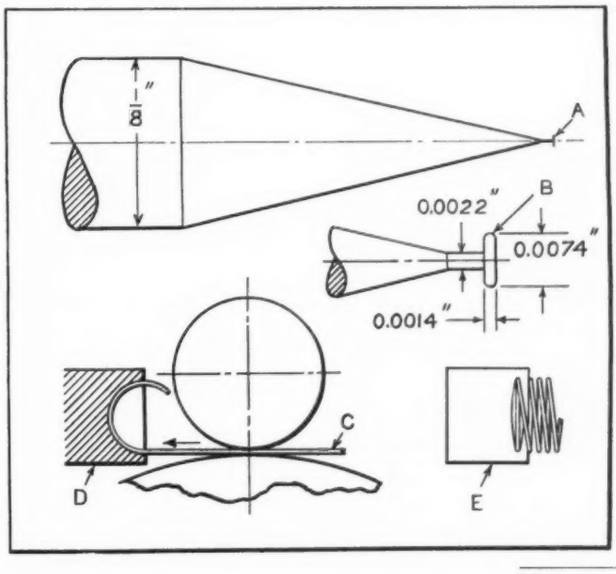


Fig. 2. Diagrams Showing Shape and Size of Lap for Lapping Diamond Coiling Die D

The job performed on the lathe consists of machining a circular lap or grinding wheel of the minute proportions indicated in Fig. 2. This lap is barely perceptible at *A*, although the illustration is enlarged to about thirteen times the actual size. The view of the lap shown at *B* is enlarged about sixty-five times the actual size. The button end of an ordinary straight pin is ten times larger in diameter than the diameter of this lap. The width of a pin head is twenty-eight times as great as the width of this lap, which is used in producing the die for coiling the filaments for 30-watt lamps. The mere application of a 1-inch micrometer to this lap would bend or break the neck of the lap.

The diameter of the lap is readily checked by the microscope *J*, Fig. 1, a graduated eye-

piece being provided for this purpose. The lap is always made 0.005 inch over size, as it becomes worn down considerably before it is fully charged with diamond dust. When the lap has been worn under size, a new lap must be made at exactly the same location as the previous one. As many as five laps are sometimes required in lapping a cavity 0.00135 inch deep in a diamond coiling die.

Every operation performed on the machine shown in Fig. 1 must be performed under the microscope. It has been found that great care must be exercised in keeping the cutting edges of the tools very sharp and well defined, because of the delicacy of the cutting operation and the small amount of material in the wheel being formed. If the finishing tools had an ordinary cutting edge, they would tend to bend the lapping wheel into a cup shape. Comparative tests were made with different kinds of tool steels, in order to obtain a tool that would hold the extremely keen edge required.

Difficulty was experienced at first in making the lap, as the shaft or neck appeared to be too weak to withstand the cutting strains without twisting off. After much experimentation, it was found that drill rod made the best and most durable lap. As early as 1926, when this job was in the experimental stage, the making of a drill rod lap was considered a lucky and important achievement. The lap required at that time was 50 per cent larger than the one shown at *B*, Fig. 2.

The first real sharp tool applied to this job was a two-carat diamond, brazed in a suitable holder and ground to a keen edge. This diamond tool was used for some time before it was broken, but the cost was prohibitive, and tool steel was tried again.

The first problem that confronted the toolmaker was how to sharpen the delicate tools used for this work. The next problem was to find a steel that would stand up with such a sharp cutting edge. However, it is now possible to complete a lap to the dimensions shown in Fig. 2 in five minutes with a Rex "AA" tool bit, ten laps being completed at one sharpening of the tool.

Referring to Fig. 1, the headstock spindle *F* is driven by an Ex-Cell-O high-speed air turbine, with a maximum speed of 65,000 revolutions per minute. The spring collet *G* is used for holding the piece of drill rod, 1/8 inch diameter by 1 inch long, from which the lap indicated at *A*, Fig. 2, is machined to the dimensions given at *B*. The slide rest *H*, Fig. 1, has a four-position tool turret *I*. The slide rest *K*, with special jeweled and balanced rollers, holds the mounted diamond die *D* to be lapped. The five units comprising the lathe are mounted on the cast-iron bench plate *L* and complete the equipment for turning the lap *B*, Fig. 2, and for lapping the cavity in die *D*.

Industrial Conditions in Great Britain

An article in *Maclean's*, a leading Canadian periodical, records the industrial progress made in Great Britain during the last few years. The author, Herbert Casson, states that in 1933, there were 463 new factories built in England and 95 old ones were enlarged and expanded to take care of increasing business. More new factories were built in Great Britain in 1933 than in any other country. During the last three years Great Britain has led the world in building. At present, houses are being built at the rate of 1000 a day, or over 350,000 a year. This building is financed to the extent of 85 per cent by private enterprises, only 15 per cent coming from public sources. New enterprises have been developed. England is even competing with Germany in the making of toys, and is selling her toys in the homeland of toy manufacture.

In this article, Mr. Casson makes the statement that the British are actually more efficient than the Americans. Having lived about twenty years each in the United States, Canada, and England, during which time he has had occasion to deal with hundreds of businesses of various types in the three countries, he may be considered as qualified to have an opinion.

The English, he suggests, are slow but sure, making steady improvements without any spectacular rise and fall, and always at a profit, even though a small one. In the United States, again, there is a tendency to want results too quickly; to sacrifice permanent profits to expensive high-pressure selling campaigns; to install elaborate systems, involving great expense in their supervision and maintenance. "The central principle of British efficiency," he says, "is common sense.... In solid and safe business building, Great Britain stands first today among the nations of the world." To fortify this statement, Mr. Casson points out that not a single bank has failed in Great Britain.

Irrespective of the accuracy of all of Mr. Casson's observations, they are well worth pondering, in view of the very definite recovery that has been achieved in Great Britain without spectacular methods.

British MACHINERY, published in London, recently said: "Throughout the British machine tool industry, firms that are not employed to their utmost capacity are the exception rather than the rule. On every side, schemes for reorganization or re-equipment are in progress or in contemplation. The Olympia exhibition, in conjunction with the general improvement in trade, has inaugurated a new era in prosperity in the industry. The prospects for 1935 appear better than for any post-war year."

Combination Die for Piercing and Slotting Angle-Bars

By R. B. BERG, Aurora, Ill.

The two-stage progressive die shown in Figs. 1 and 2 is used for hot-piercing two round holes *A*, Fig. 3, two oval holes *B*, and from two to four spike slots or holes *C* in the high-carbon alloy steel angle-bar *D*. Sections of various other shapes and sizes are also pierced by these dies.

The special Danly die set illustrated is fitted with large guide posts and weighs approximately one ton. It can be used for piercing and slotting any one of various other different sections and sizes of angle-bars by simply changing pads *E*, Fig. 1, and punch tips *F*, along with the spike dies and punches *G* and *H*. Change-overs are made immediately after completion of a run in about one-half hour, while the die steel has a temperature of about 600 degrees F.

All button dies and punch tips are made from a

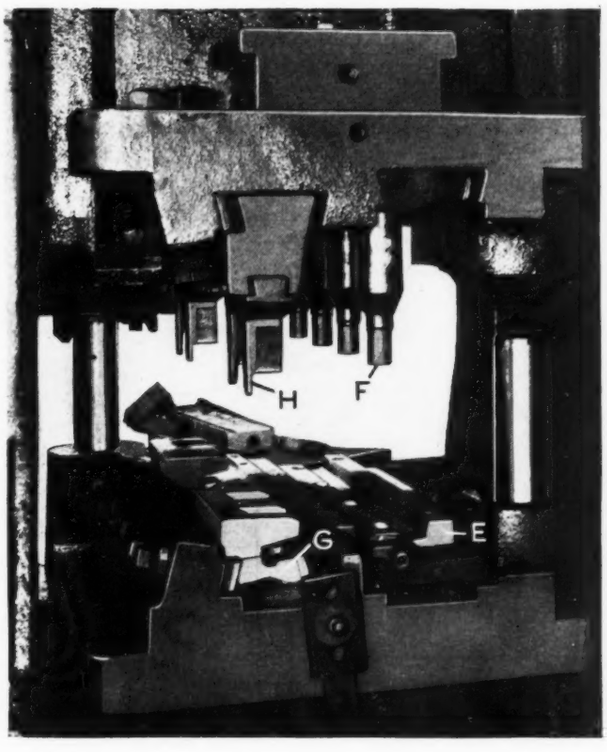


Fig. 1. Die for Hot-piercing Holes and Slots in Angle-bars D, Figs. 2 and 3

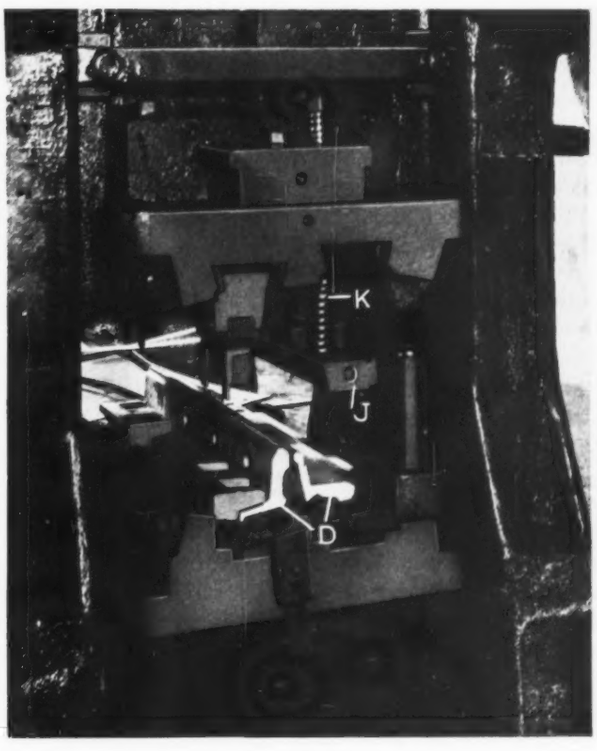


Fig. 2. Die Shown in Fig. 1 with Work D and Stripper Bar J in Position

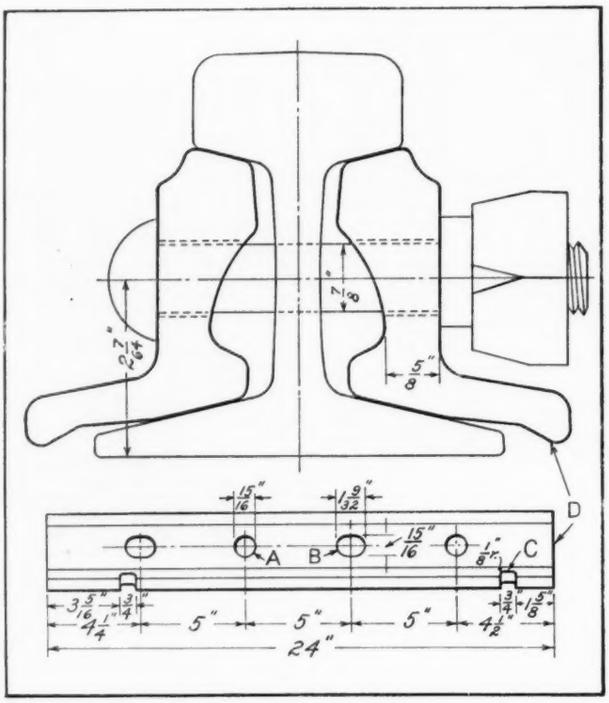


Fig. 3. (Upper View) Enlarged End View of Pierced and Slotted Bar D Shown in Lower View

commercial alloy steel for which a special heat-treatment has been developed in our plant. The cutting edges of these tools did not stand up with commercial heat-treatment. Stops during a run for grinding punches are virtually unknown. Runs of fifty thousand to eighty thousand bars, comprising a complete order, are punched without trouble or stops of any kind. No trouble has been experienced with these dies from punch tips or hold-down screws coming loose or from the shifting of punch-holders. In addition, the accurate alignment and positioning of the holes in the work is positively maintained.

The stripper *J*, Fig. 2, also does the work of a pressure pad. The punch clearance holes in this stripper are elongated to accommodate angle-bars with any spacing of bolt holes within its limits. The heavy pressure built up by the stripper springs prevents the angle-bar from becoming distorted while being pierced, and no straightening operation after punching has been found necessary. There is absolutely no bulging over the pierced bolt holes, as is generally the case when dies of the usual type are employed.

The stripper springs *K* are especially made up from heat-resistant alloy steel and work over the hardened punch-holders. The stripper is held in place by two cap-screws, and is mounted on two rods designed to act as positive knock-outs in case of spring failure.

The angle-bars are brought up to the correct temperature for the piercing operation in a continuous furnace. On leaving the furnace, the hot bar is descaled so that it is absolutely clean by a method for which a patent has been applied. It is then forged to the desired shape and size in one blow in a 1000-ton press. The next stage is the piercing and slotting operation. After this operation, the bars are given a final heat-treatment which completes the work.

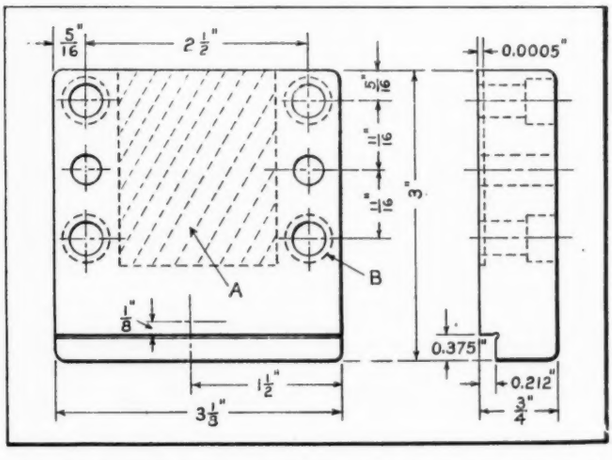
A production of four hundred to five hundred bars, or about five to seven tons, per hour, depending on the size and weight, is maintained continuously. Two men operate the press. One man pulls one bar out with tongs after each stroke of the press, and the other man flips the bar over from the bolt-hole position to the spike-slot side while another bar is pushed into the die on the bolt-hole side from the back of the press. The time elapsed in making up a bar, from the time it leaves the furnace until it reaches the quenching tank, is about twenty seconds.

One of the interesting features of the dies is the design of the punch tips. Only a few ounces of steel are required for these tips, as they are barely longer than the thickness of the steel they punch. Therefore, no trouble is experienced from warping during hardening, which saves considerable tool-room time. The life of each punch tip averages 160,000 holes, or about three grinds, after which they are discarded because they become too small in diameter. The unusual die life can be attributed to especially developed heat-treatment of dies and punches, correct die design, and to the fact that the work is kept free from scale.

Relieving Gage Surfaces to Compensate for Compression of Fastening Screws

By JACK FINLAY, Assistant Manager
Small Arms Factory, Lithgow, Australia

There is one detail of gage-making on which the writer has seen no information in MACHINERY—namely, the effect produced by the compression of parts of gages resulting from the tightening of the



Gage Part with Cross-hatched Area A Relieved 0.0005 Inch

screws used to clamp the parts to the main body of the gage. In the case of four parts secured to the main body of a built-up gage by screws and dowels, it was the experience of our gage-makers that unless the surfaces adjacent to the bearing areas immediately surrounding the screws were relieved to a depth of about 0.0005 inch, there was a measurable difference or discrepancy in the dimensions of the gage when checked for accuracy by means of slip gages.

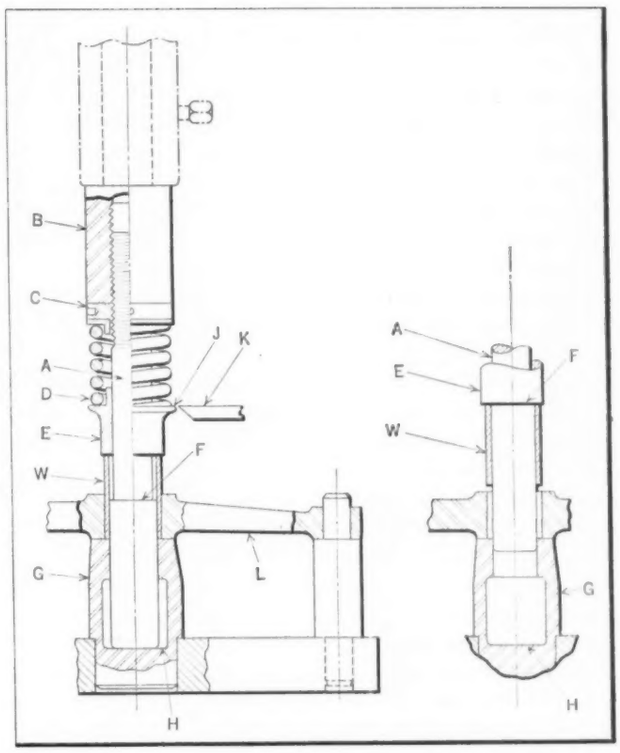
In the accompanying illustration, the cross-hatched area *A* shows where the part has been relieved to compensate for the compression caused by the screws used in holes *B*. Attention might be called to the fact that this is not an isolated case in which such treatment has been found necessary. Similar trouble has been experienced for many years—in fact, ever since we began using slip gages or size-blocks for checking our gages.

Jig for Drilling Cross-Head Guide

By C. W. PUTNAM, Athol, Mass.

A jig of novel design for use in drilling eight holes in a cross-head guide is shown in the accompanying illustration. The principal feature of this jig is the centering arrangement, which insures having the holes drilled in the base of the guide in the correct positions relative to the bore. The cross-head guide is first milled at *X* and *Y*, after which it is bored at *Z*.

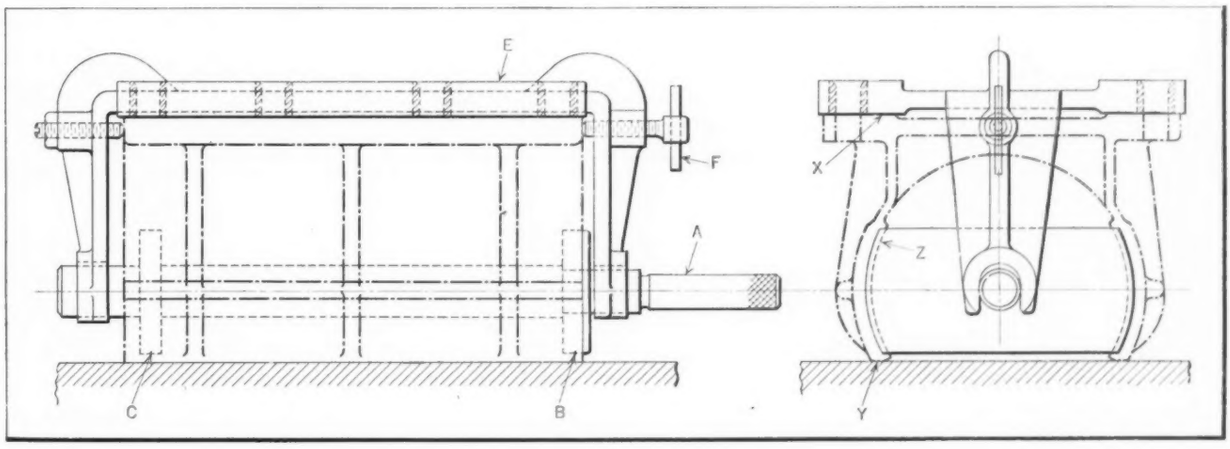
Arbor *A* is provided with two locating plates *B* and *C*, turned on the outside to a sliding fit in the bore of the guide and pressed on arbor *A* as shown. The locating plate *B* has a stop flange. Bushing plate *E* is cast with two overhanging arms having forked ends finished to fit arbor *A* as shown. To operate this jig, the arbor is inserted in the guide and the bushing plate dropped down on the guide, after which thumb-screw *F* is tightened, thus locating the jig in the correct position for drilling.



Fixture for Pressing Thin-wall Bushing into Hub of Lever

Arbor Press Fixture for Pressing in Thin-Wall Bushing

The accompanying illustration shows a manually operated tool for pressing a thin-wall bushing *W* into the hub of a lever *L*. The thin cross-section of the bushing, the unsupported end projecting beyond the hub, and the necessity for the maintenance of accurate alignment make it essential that the assembling operation produce a minimum of bushing distortion. Since rapid operation is essential, manual control of the pressure and of the stopping of the downward movement when the bushing comes in contact with the end of the bushing *G* is impractical.



Jig Used in Drilling Eight Holes in a Cross-head Guide

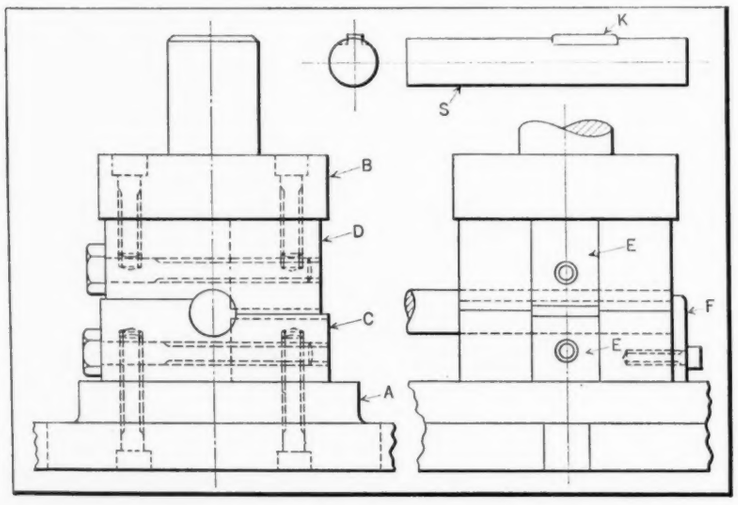
The tool shown, which controls the maximum bottoming pressure, is constructed as follows: Pilot bar *A* is a slip fit in bushing *W* and is threaded to fit adapter *B*, which is held in the press ram. Nut *C* locks bar *A* to adapter *B* and also provides means for adjusting the load of spring *D*. Spring *D* holds collar *E* against shoulder *F* of bar *A* when in the position shown in the view to the right. Bushing *G* guides bar *A* and limits its travel when it strikes surface *H* of bushing *G*, as shown at the left.

Operation of the fixture is as follows: The lever is placed on the locating pins, only one of which is shown, the hub resting on bushing *G*. Bushing *W* is slipped on bar *A* and held against collar *E*. The descent of the press ram causes bar *A* to enter bushing *G* and bushing *W* to enter the hub. When bar *A* strikes surface *H* of bushing *G*, bushing *W* has bottomed and spring *D* has been deflected to give the maximum pressure at the position shown in the view to the left. The preloading of spring *D* when in the position shown to the right is sufficient to press bushing *W* into the hub; however, should bushing *W* fail to bottom when bar *A* comes in contact with surface *H*, the edge *J* of collar *E* will be above gage *K*, and the assembly should be rejected because of excessive press fit allowance. R. P.

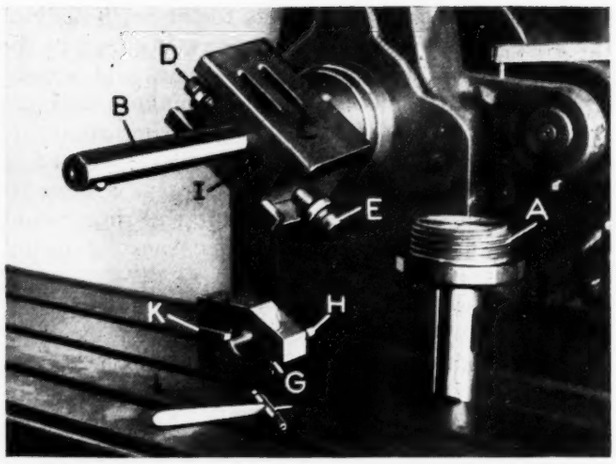
Die for Cold-Forming Key on Shaft

By H. R. SCHMIDT, Philadelphia, Pa.

In the accompanying illustration, is shown a punch and die for forming keys on shafts, such as the one indicated at *K*. The hardened steel blocks *C* and *D* are attached to the base *A* and the punch-holder *B*, respectively. The blocks are bored to suit the diameter of the shaft *S* on which the key is to be formed. The hardened inserts *E* extend into the bored hole far enough to cut into the shaft and form the key. At *F* is a gage for locating the shaft.



Die for Cold-forming Key K on Shaft S



Jig Boring Tool Mounted on Nose of Milling Machine Spindle

Jig Boring Tool for Milling Machine and Lathe

By AVERY E. GRANVILLE, Knox, Ind.

The boring tool shown in the accompanying illustration is one of the best that the writer has seen. It is shown attached to the spindle of a milling machine, where it is used most of the time. Occasionally, however, it is used on a lathe spindle when the work is of such a nature as to permit it to be clamped to the tool-slide or the saddle. The tool may be screwed directly on the nose of the spindle or the taper shank adapter *A* may be used.

The boring-bar *B* may be of any desired size. It can be fitted to the tool-block either by making the shank large enough to fit the hole in the slide or by using a bushing. The bar is clamped in the hole in the slide by means of two headless set-screws. These set-screws are reached through the slots *C* in the body by means of the special wrench *L*. The heavy-collared adjusting screws *D* and *E* on each end of the tool-slide make it easy to set the boring-bar exactly where needed, from a central position out to the extreme capacity of the tool.

When it is desired to face the boss on a jig or fixture, the tool *G* may be placed over the boring-bar and locked in place with a headless set-screw. In this case, the driving pin *H* fits into the hole *I* in the tool-block. The boss-facing cutter is shown at *K*.

* * *

There is too often an implication that credit is something that can be called into existence at will. Credit, on the contrary, is something that must be *earned*, not *made.—David A. Weir in Commerce and Finance*

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

H. R. C.—What kind of steel is suitable for heavy hammer dies, such as are required in making silverware, and how should the dies be heat-treated?

A.—According to an article by William E. Snow in July, 1933, MACHINERY, page 697, chrome-vanadium steel of the grade known commercially as Type K, with an analysis of: Carbon, 0.80 per cent; chromium, 0.60 to 0.80 per cent; vanadium, 0.15 to 0.20 per cent; manganese, 0.35 to 0.50 per cent; silicon, 0.20 to 0.35 per cent; and phosphorus and sulphur, 0.03 per cent maximum, gives very satisfactory results for such dies. It hardens to a depth of 1/4 to 3/8 inch, with a scleroscope hardness of 85 to 90. Complete details on the heat-treatment of this steel are given in the article mentioned.

Bearing Failures in Wick-Lubricated Electric Motors

J. A. R.—In our plant we have several hundred very small wick-lubricated electric motors. For the first few months after they were installed they operated perfectly on an oil of 250 seconds at 100 degrees F. viscosity. Now we are experiencing an epidemic of bearing failures. This is undoubtedly a lubrication problem. Can you suggest a solution?

Answered by the Editor of "Oil-Ways," Published by the Standard Oil Co. of New Jersey

As you surmise, the problem is one of lubrication, and two steps should be taken to remedy it: (1) Replace the oil that you are now using, which is too viscous for proper feeding, with an oil of 90 to 100 seconds at 100 degrees F. viscosity; (2) inspect the wicks on all motors and remove any glaze or hardness at the point of contact with the shaft.

Correct Procedure in Straightening Broaches

H. R. M.—What procedure should be followed in straightening broaches that have been warped by the hardening operation?

A.—Thin, flat broaches, as well as small round ones, are readily straightened by placing them on a surface plate and striking them smartly with a light hammer, protecting the edges of the teeth where necessary by holding a piece of soft babbitt metal against them.

Broaches of larger section, which are too stiff to yield readily to this treatment, are handled in a straightening press as follows: Place the broach on a surface plate and mark with chalk the spots to be straightened. Place it in the press with one of the spots to be straightened in position for bending and heat that part only with a gas torch. Heat the steel slowly and uniformly by moving the torch to and fro during the process, exercising great care not to overheat it and thus draw the temper. If the broach was tempered at 380 to 400 degrees F., for example, the straightening heat should not be permitted to exceed 350 degrees F. To check up on this temperature, use short pieces of 50-50—half tin, half lead—wire solder which melts at slightly under 350 degrees F. Keep testing the temperature of the broach during the heating process by holding one of the pieces of solder against it. When the solder melts, the broach is ready to be straightened.

Apply pressure until the broach is not only straight, but even bent slightly in the opposite direction, to allow for springing back when the pressure is released. Cool the broach quickly with cold water from a hose, to set it before releasing from the press. Any other parts of the broach that require straightening may then be treated in the same manner.

Liability of Builder for Accidents Due to Defects in Machinery of His Manufacture

M. D. A.—We are manufacturers of machinery. If some defect should develop in any equipment that we have built and sold that might be the cause of a personal injury to an employe of our customer, would we be liable for such personal injury if our customer should bring suit against us? Also, could the dealer who had actually made the sale to the customer of equipment that we manufacture be held liable? And, if the dealer could be held liable, could he, in turn, bring suit against us as manufacturers?

Answered by Leo T. Parker, Attorney-at-Law Cincinnati, Ohio

It is well established law that a manufacturer is liable for an injury sustained by a purchaser or his employes who have legal right to operate the machinery, where it is shown that the accident resulted from negligence on the part of the manufacturer. Also, it has been held that a manufac-

turer, general agent, and retail dealer, all may be liable for injuries caused by defective equipment.

For instance, in King Co. v. Ennis, 147 S.E. 119, it was disclosed that a manufacturer produced a defective appliance. The appliance was sold by the manufacturer's state agent to a retail dealer who, in turn, sold it to a user. As a result of the defect in the appliance, the user was severely injured and filed suit to recover damages against the manufacturer, state agent, and retail dealer. During the litigation, testimony was introduced proving that the defect could have been discovered by the manufacturer, state agent, or retail dealer, if ordinary care had been exercised. The Court held the injured person entitled to recover damages, and said:

"All three of the defendants were negligent and liable to the plaintiff (injured person) because of having manufactured, furnished, and sold a defective appliance... It is the general rule that the vendor or dealer, who is not the manufacturer, is under no obligation to test an article purchased and sold by him for the purpose of discovering latent or concealed defects, and that, when he purchases and sells an article in common and general use, in the usual course of trade, without knowledge of its dangerous quality, and with nothing tending reasonably to call his attention thereto, he is not negligent in failing to exercise care to determine whether it is dangerous or not. In such a case, he may assume that the manufacturer has done his duty in properly constructing the article, and in not placing upon the market a commodity which is defective and likely to inflict injury... We think it may be reasonably inferred from all the facts alleged that the defect was one which a reasonably prudent dealer should have discovered before placing it upon the market."

In another case (Baker & McDowell Co. v. Ellis, 115 So. 425), it was shown that a person purchased a machine from a dealer who issued to the seller a copy of an order form containing a printed warranty, as follows: "It is agreed that this purchase is made by me, subject to the provision of the standard warranty of the manufacturer which is printed on the back of and made a part of this order, and that it is the only warranty, either expressed or implied, made under this order, or otherwise." The manufacturer's guarantee was the usual one, which guaranteed parts against defects for a period of ninety days.

In this case, it was indicated that a dealer who has an agency to sell a manufacturer's product must be careful to ascertain that the order forms supplied by the manufacturer do not contain statements of guarantees; otherwise, the dealer is liable for these guarantees to the same extent as the manufacturer.

Obviously, the manufacturer is not liable for any injury sustained as a result of a defect in machinery, unless convincing testimony is introduced proving that the manufacturer either failed to have the machinery inspected before shipment, or, if an inspection was made, that the inspector failed to exercise ordinary care to discover the defect that caused the injury. If the defect is latent and cannot be discovered by ordinary inspection, then the manufacturer never is liable for an injury sustained by a user of the machine.

The important consideration of the Court, when deciding a litigation of this nature, is: Would the defect that caused the injury have been discovered by an average experienced inspector who used ordinary care in making the inspection? If so, then the manufacturer is liable. On the other hand, if the defect is concealed and not discoverable by an ordinary careful inspection, then the manufacturer is not liable.

If the dealer is held liable, he may sue the manufacturer to recover the amount of his losses, and he can obtain a favorable judgment if he proves that the defect resulted from the manufacturer's negligence and that he, the dealer, could not discover the defect by ordinary care. Under these circumstances, generally, the manufacturer is not liable to the dealer unless the defect which caused the injury is apparent only before the machine is assembled, but concealed after the machine is assembled and ready for shipment.

Another important point of the law is that the person who is injured cannot recover damages from any one, if the evidence proves conclusively that the injured person was negligent in failing to discover the defect, or should have discovered it if he had been as careful as the average prudent man would have been under like circumstances.

* * *

The Right Road to Recovery

The three R's of the depression, Recovery, Relief, and Reform, and their influence on permanent employment were analyzed in an address on the "Problems Confronting the Durable Goods Industries," by Franklin R. Hoadley, vice-president of the Farrel-Birmingham Co., Inc., Ansonia, Conn., and chairman of the Code Authority of the Gray Iron Foundry Industry, delivered before the Providence section of the American Society of Mechanical Engineers.

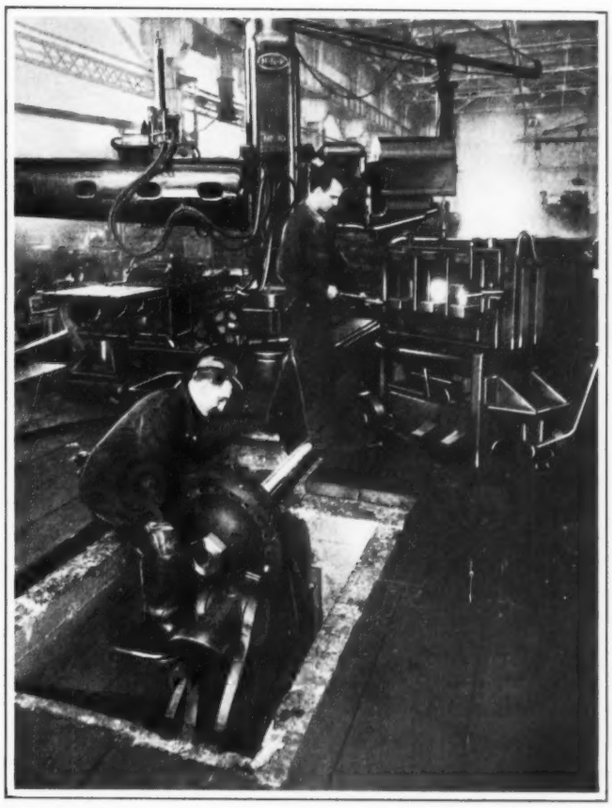
"Depression," the speaker said, "is essentially a condition of unemployment. Recovery alone can bring about re-employment and an end to the depression. Re-employment is the only satisfactory form of relief. An aroused and informed public opinion will demand necessary reforms without the cruelty and injustice of impracticable and idealistic reforms which tend to retard employment. Therefore, since recovery will assure the greatest measure of relief and, since reform can be of little benefit without recovery, let us marshall the three R's of the depression into their proper sequence of Recovery, Relief and Reform, and put the greatest emphasis on the leader of these forces, Recovery."

The Scrap Heap Yields a Machine for Riveting Piston Bull-Rings

By OLIVER HERBERT

Riveting the bull-ring to locomotive piston heads used to be a hard job at the Battle Creek, Mich., shops of the Grand Trunk Railway System, requiring the efforts of three men for three-quarters of an hour. One man drove the rivet heads with an air hammer, the second man backed up the opposite end of the rivets with a dolly bar, and the third man heated the rivets. This work was done in the boiler shop, to which the parts had to be conveyed from the machines on which they were finished.

Now the operation is performed entirely in the machine shop in ten minutes by only two men. This saving in time and labor has been made possible by the home-made machine here illustrated, which consists primarily of an old gap type riveting machine that had lain on the scrap heap for two years. It was rebuilt to meet its present application. A 5-inch air piston provides power for driving the rivet heads. The opposite ends of the rivets are rigidly supported by a vertical arm of the machine frame; consequently, there is no horizontal movement of the work during the operation.



Equipment that Has Transformed the Riveting of Bull-rings from a Fatiguing Job to an Easy One

The piston-rod rests on rollers, so that the entire unit can be rotated to bring the successive rivet holes in the piston head into position in line with the hammer. An air-operated device lifts the piston head slightly between the riveting operations to facilitate turning the piston head and rod by hand. In the average job, twenty rivets, 7/8-inch in diameter by 4 inches long, are driven. An adjustment is provided for changing the center distance between the piston-rod and the air hammer to suit piston heads of various diameters.

This equipment has been installed in a pit, where it is entirely out of the way when not in use. The rivet heater is of the electric type.

There is Plenty of Business Ahead in the Machinery Field

There is no denying that many of the measures incorporated in recent laws have been commendable, but, as is always the case in a program of sweeping changes, the pendulum can swing just too far the other way. One indication of this is the results that have followed the enactment of the Federal Securities Act. While it has its good points, the fact is that such far-stretched interpretations have followed, that investors and business men have hesitated about putting any new money into business. Consequently, at least in the world of machinery manufacturers, without new and essential capital many companies have been hard pressed to undertake much needed projects that would certainly mean more productive activity and more employment.

Restore some measure of confidence to the man who wants to remodel his factory and the investor who is willing to finance the bill, and there can be no doubt that our recovery trend must be gradually but constantly upward. The durable goods requirements of the United States right now are so far behind what we all knew as normal in 1930 that, with any kind of assurance that would bring direct action, we would have enough business to keep our shops and our workers occupied on a full-day basis for at least the next seven or eight years.—*John W. O'Leary, president of the Machinery and Allied Products Institute*

* * *

Information Desired on Large-Size Spring Motors

Has anyone ever built spring motors in sizes of one or more horsepower? If so, a correspondent would be pleased to obtain information about them through MACHINERY. Simply address editor, MACHINERY, 148 Lafayette St., New York.

Can We Establish Equitable Conditions in Industry?

An Effort to Clarify the Current Thought on Capital and Labor and a Suggested Plan for the Establishment of Friendly Cooperative Industrial Relations

By C. R. ROSBOROUGH, President and General Manager
Moline Tool Co., Moline, Ill.

THE National Industrial Recovery Act, if not repassed, will automatically terminate on June 16, this year. It certainly should not be repassed in its present form, because it has not furthered recovery in the manner hoped for by its sponsors; it has not inspired the men upon whom we depend for initiative and leadership in business and industry with confidence in our institutions; and it has engendered industrial strife and disputes. What we need in its place is legislation that will build up confidence and promote friendly relations between employers and employes. How can such legislation be best promoted?

I believe that if industry does not sponsor some rational plan to take the place of the present Recovery Act, drastic legislation will be passed, detrimental to business men and working men alike. Business men in every field should settle on a definite plan to be presented to Congress and should unanimously support its adoption. We have, in all probability, reached a point in our civilization where the old order cannot be continued. No matter what stand industry takes, the relations between capital and labor will be on a different basis in the future.

It is for industry to propose a reasonable plan that will end the confusion into which the country has been thrown. To prevent more drastic steps, detrimental to all, except, perhaps, to a few self-appointed promoters of unrest, industry must be willing to accept changes that will promote the welfare of the nation as a whole. With this in view, the following plan is proposed for discussion.

Three Factors are Necessary to Create a High Standard of Living

To carry on an industrial enterprise and to produce the material things necessary for the comfort and well being of all, three elements are necessary —natural resources, labor, and capital. In this discussion, we will omit reference to natural resources, fundamental as this factor is, because they present a problem of their own which doubtless will have to be solved sooner or later; and an adequate solution for which has been proposed, although not acted upon, long ago. We will simply deal with the relationship of labor to capital.

If labor did not have the use of capital—that is, of the machines, buildings, means of transportation, etc., necessary to production—it could accomplish practically nothing. All it could do would be to wrest a bare living from the soil like the savages do. Likewise, if capital did not have the cooperation of labor, it could accomplish nothing. The machines and buildings would stand idle and empty.

But remember that labor includes not only those that work with their hands, but *all* through whose efforts, mental or manual, the work of an enterprise is directed and carried out. To the extent that the owner or head of a company works and plans for the efficient management of his plant, he is a worker. He is part of labor. To the extent that he has furnished the capital—that is, the machines and buildings by and in which the work is carried on—he represents capital.

Since Labor and Capital are Both Equally Necessary, Both are Entitled to Their Wages

It is generally admitted that labor—that is, workers of all classes—should have first claim on the returns of a business. But we have never thought of capital as being entitled to *its* wages—that is, interest—except when the business makes a profit over and above the expenses of labor, material, and fixed charges (such as taxes, insurance, interest on borrowed money, etc.).

It seems to me that we have reached the point in our civilization where we should consider that capital is entitled to a just compensation, the same as labor. There should be a payroll for the savings invested in machines and buildings, as well as a payroll for the workers. This compensation to capital should be considered as an element of the cost of the product, like labor, material, and fixed charges; and capital should receive its compensation on the same basis as labor, at regular intervals.

It should be fixed on a reasonable basis, the same as wages, at a percentage such as will induce people to put their savings into equipping factories that will provide employment for labor.

What Would be Done with the Profits of the Business?

If, after a year's operation, profits have been made over and above the wages to labor and capital and all other expenses, this profit should be divided for the benefit of all concerned—labor, capital, and the safeguarding of future operations of the business. What the profits of the business actually are would have to be determined by a firm of certified public accountants. For example, suppose that in a small business there were a profit over and above the items mentioned of, say, $75,000. These funds could be divided into three equal amounts of $25,000 each, one to go to the workers in proportion to the wages they had earned during the year; the second to go to the stockholders who have provided the machinery and buildings with which the work is done; and the third to be set aside as a reserve to maintain the business in slack periods.

The part that goes to labor may or may not be paid out directly in cash. It would be preferable to set aside part of it for unemployment insurance and sick benefits and part of it for the purchase of an annuity (old-age pension) which would provide an income at the age of sixty or sixty-five. These are details that could be worked out later; the important thing is the acceptance of the principle involved.

A man would not have to stay with one employer in order to get the benefits from the unemployment insurance, sick benefits, and the old-age pension. These funds would be in charge of some centralized agency and would accumulate whether he worked in one city and state or another.

The Benefits of the Plan Proposed

It is obvious that if a plan such as proposed were adopted on a national scale, it would provide all the benefits of unemployment insurance, sick benefits, and old-age pensions about which so much is being said at the present time, and provisions for which will, without doubt, be enacted into law (unwise laws at that) unless business makes a rational proposal that will meet with general approval.

It is obvious that the working of the plan and the safeguarding of the funds should be left in the hands of responsible institutions and not to the whims of politicians. It may be necessary for men prominent in business to take a more active part in politics in order to make the plan successful. Such a plan would promote friendly relations between employer and employes, and eliminate the strife and disturbances that result in losses to workers and employers alike.

There are only three groups of people that would be likely to oppose such a plan—politicians who have their own interest rather than the interest of the people as a whole at heart; that group of employers who are unable to grasp the significance of the changing conditions; and those labor leaders who are promoting their own interests at the expense of the workers whom they have organized. All others who contribute to producing the material things on which our standard of living is based would see the benefits. The workers would have a real interest in the welfare and prosperity of the business in which they are working, and everyone would profit by the maintenance of industrial peace and the promotion of prosperous conditions.

Society of Automotive Engineers Celebrates Thirtieth Anniversary

The thirtieth anniversary of the Society of Automotive Engineers was celebrated at the Society's annual dinner in New York during the recent Automobile Show. It was thirty years ago that seven far-sighted men sat down in the New York headquarters of the Automobile Club of America and formed the Society of Automotive Engineers. At the thirtieth anniversary dinner, a large number of members who have made outstanding contributions to the science and art of automotive engineering were honored with life membership in the Society.

Since 1910, when its first standardization work was initiated primarily for motor vehicles, the Society has, by gradual extension, taken over similar important work for manufacturers of gas engines, marine engines, and aircraft engines. These standards are recognized all over the world. Enormous sums have been saved to the American public by the application of these standards in the quantity production of automobiles, trucks, and aircraft.

The annual meeting of the Society was held at the Book-Cadillac Hotel in Detroit, January 14 to 18. Sessions were devoted to almost every phase of the automotive industry. At the production session, recent outstanding developments in production machinery and methods were discussed. Among the subjects dealt with may be mentioned: Surface finish and how it can be measured; camshaft grinding equipment; single-point boring of cylinders and diamond-turning of pistons; improving the machineability of alloy steels; triple-action drawing and redrawing presses; and modern resistance welding in the automobile industry.

Formulas for Estimating Milling Machine Production

By JOSEPH OLSON

WHILE associated with a concern building heavy-duty high-production machine tools, the writer frequently found it necessary to answer customer's or prospective customer's inquiries regarding the production rates, number of fixtures required, feed rates, speeds, and similar questions. The answers in the case of a rotary milling machine with the cutter and the work arranged as shown in Fig. 1 are easily obtained. When the table is rotated at two different speeds during one revolution and the working sector differs in magnitude from the "space" or non-cutting sector, as indicated in Fig. 2, the information is not so easily found. The "straight-in-line" milling job shown diagrammatically in Fig. 3 is in the same class as the rotary milling work shown in Fig. 2.

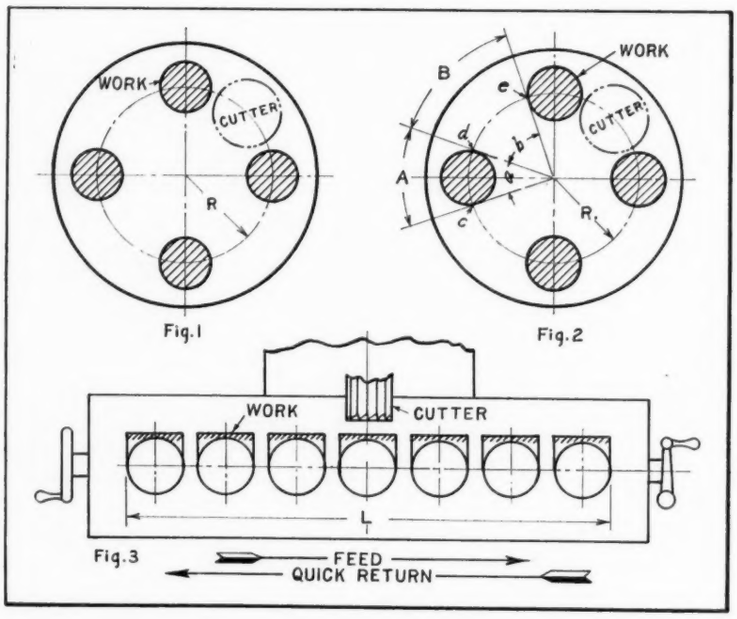


Fig. 1. Diagram Showing Set-up for Continuous Rotary Milling. Fig. 2. Same as Fig. 1 except that Rapid Traverse is Used. Fig. 3. Set-up for Straight-line Milling, Using Rapid Traverse for Returning Table

Being assigned a large portion of the work of answering questions such as those mentioned, the writer developed the formulas given in this article to enable him to answer quickly and easily the questions most commonly asked.

Only the most important factors are given. Those less frequently required can be readily obtained by transposition. Only one cutter is shown in Figs. 1 and 2. Most of these machines, however, have two cutters—a roughing and a finishing cutter. This fact, however, does not affect the formulas.

Some of the large machines having two roughing and two finishing cutters can be treated as two separate machines, because, other things being equal, they give double the output of two-cutter machines of similar design. For continuous milling operations such as considered here, no cutter marks were produced on the work, as the cutter heel is tipped away from the work, the cutter-head being tilted so that the heel or part of the cutter that passes over the work last clears the work by about 0.002 inch.

Whenever the shape of a piece of work is such that it prevents the cutter from immediate engagement with the next piece, as, for example, with pieces having large bases on which only small parts are to be machined, the rapid traverse is used. In this case, when the work comes in contact with the cutter, it is fed slowly at the cutting speed until the surface is completely machined, after which the rapid traverse is engaged, carrying the table quickly to the point where the next piece of work comes in contact with the cutter. Thus, it will be seen that, in the case of the work shown in Fig. 2, the table will move at the feeding rate through arc *A* and at the rapid traverse rate through arc *B*.

Formulas for Continuous Milling

Formulas for obtaining the information generally required in the case of continuous milling operations such as indicated diagrammatically in Fig. 1 are as follows:

$$P = \frac{Trpn}{2R\pi} = \frac{Trpn}{6.28R}$$

$$r = \frac{6.28PR}{Tpn}$$

$$p = \frac{6.28PR}{Trn}$$

in which
P = production in time T = number of pieces;
T = time in which production P is accomplished, in minutes;
p = number of fixtures;
n = number of pieces in fixture;
r = feed rate, in inches per minute; and
R = radius at which feed rate is calculated, in inches.

Formulas for Continuous Milling with Rapid Traverse

When rapid traverse is recommended, as indicated in Fig. 2, the following formulas apply:

$$\text{Time for one revolution} = \frac{Ap}{r} + \frac{Bp}{Q}$$

$$\text{Revolutions in time } T = \frac{T}{\frac{Ap}{r} + \frac{Bp}{Q}}$$

$$P = \frac{T}{\frac{Ap}{r} + \frac{Bp}{Q}} \times pn \qquad r = \frac{Ap}{\frac{Tpn}{P} - \frac{Bp}{Q}}$$

in which
n = number of pieces in fixture;
p = number of fixtures, or number of spaces B;
r = rate of feed on arc cd, in inches per minute;
Q = rate of rapid traverse on arc de, in inches per minute;
R = radius at which rate of feed is calculated, in inches;
A = length of arc cd = 0.01745 × angle a (in degrees) × R;
B = length of arc de = 0.01745 × angle b (in degrees) × R;
P = production in time T = number of pieces; and
T = time in which production P is accomplished, in minutes.

Formulas for Straight-Line Milling with Quick Return

The following formulas are used in the case of straight-line milling with a quick return feed, as indicated diagrammatically in Fig. 3.

$$P = \frac{Tp}{\frac{L}{r} + l + \frac{L}{R}}$$

$$p = \frac{P\left(\frac{L}{r} + l + \frac{L}{R}\right)}{T}$$

$$r = \frac{L}{\frac{Tp}{P} - \left(\frac{L}{R} + l\right)}$$

in which
L = length of table feed, in inches;
r = feed rate, in inches per minute;
R = quick return, in inches per minute;
l = time for loading and unloading, in minutes;
p = number of pieces per cycle, or number of fixtures × pieces per fixture;
T = time, in minutes, in which production P is accomplished; and
P = production in time T = number of pieces.

* * *

Single-Point Boring of Cylinders

At the Production Session of the annual meeting of the Society of Automotive Engineers, held January 18 in Detroit, W. F. Wise, of the Ex-Cell-O Aircraft & Tool Corporation, read a paper entitled "Single-Point Boring of Cylinders and Diamond Turning of Pistons." In this paper, some interesting and important information was given on the subject of the boring of cylinders. The author pointed out that, in the past, most firms used a reamer before the honing operation. This procedure has not always been wholly satisfactory, and for this reason, the single-point boring method was developed.

With a machine for single-point boring of the cylinder block, eight holes can be bored in one operation. It is possible to maintain a tolerance of 0.0003 inch for "out-of-roundness" and diameter of hole, with a maximum alignment error of 0.001 inch for parallelism with the center line throughout the entire length of the bore. When V-type eight-cylinder blocks are bored, four holes are bored in one operation. Using tungsten-carbide tipped single-point tools, the production is thirty eight-cylinder V-type blocks an hour.

By this precision cylinder-boring process, only from 0.0005 to 0.0007 inch is left in the bores for honing, while by former methods, from 0.002 to 0.004 inch was generally left by most manufacturers. By leaving such a small amount of stock, with a uniformly round and straight hole, it is obvious that the limits on the finished product can be held to more exacting tolerances than was formerly possible, and at the same time, the rough-honing operation is eliminated.

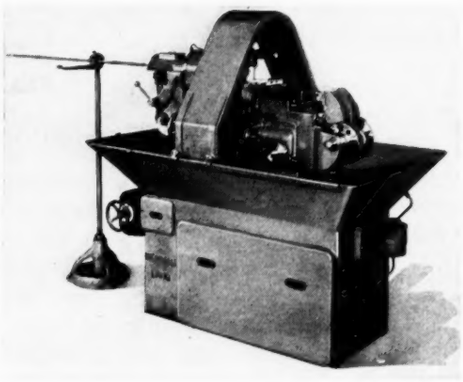
* * *

The bogy of "over production" still frightens the planners, although production forms the only market for production, and the National Survey of Potential Production Capacity reports that, in the last five years, the people of this country have deprived themselves of goods and services to the amount of $287,000,000,000 which they might have had by simply continuing to work. Well, why didn't they continue? What stopped them? The right answer to this question will forever put a stop to such stoppages.—*Commerce and Finance*

Seen at the Olympia Exhibition

From Our London Correspondent

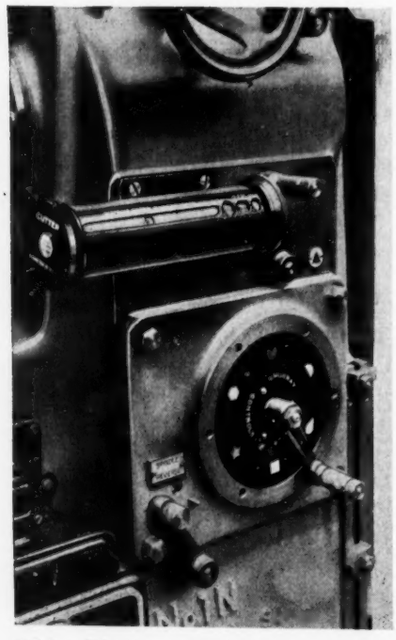
A BRIEF outline of the machine tool and engineering exhibition held at London, England, in November, was published in January MACHINERY, page 297. In the present article, a few of the outstanding developments seen at the exhibition will be mentioned. To describe in detail the many new features of interest that characterized this vast display would be impossible in a brief review. Certain developments, however, seem to demand a few words of comment.



Wickman-Lang Three-operation 5/8-inch Bar Automatic with Cam Feed for the Tool-slides

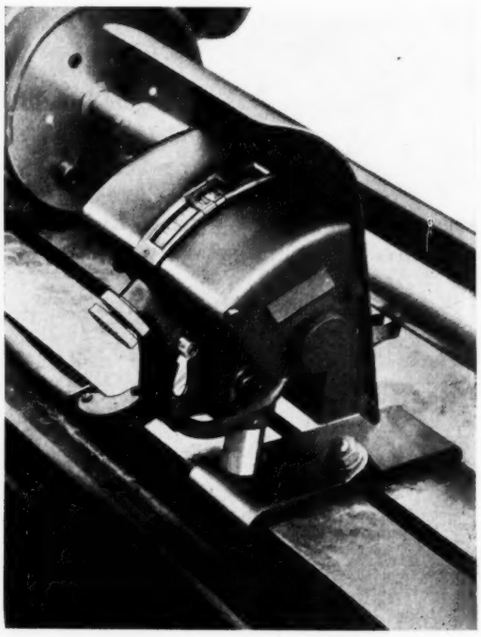
Among the most outstanding of the many remarkable machines on exhibition was the new Hydroptic jig boring and milling machine built by the Société Genevoise, Geneva, Switzerland. In this machine, radical departures from previous designs are incorporated. Its scope is extended by the provision of facilities for milling, in addition to drilling and boring. Of special note is the fact that a new system of work location and table and cutter-head adjustment is employed. The use of measuring screws is dispensed with entirely. The table is traversed hydraulically; but with the piston fixed, fine adjustments can be made by means of a screw. It must be understood, however, that this is not a measuring screw. Experienced operators find it possible to bring the table to the desired setting within 0.0001 inch without recourse to the adjusting screw.

A hydraulically operated plain grinding machine which was exhibited by the Churchill Machine Tool Co., Ltd., is equipped with the firm's patented Hydrauto wheel-head. Among the advantages claimed for this head is the automatic bearing adjustment which it provides. In hydraulically operated vertical broaching machines, a departure from previous European practice is made in the Forst machine, which was shown by A. C. Wickman, Ltd. The broach is pulled downward through the work, which rests on a flat table, instead of upward, with the job in contact with the under side of a suspended table. Other hydraulically controlled machines of special interest included a Heller thread

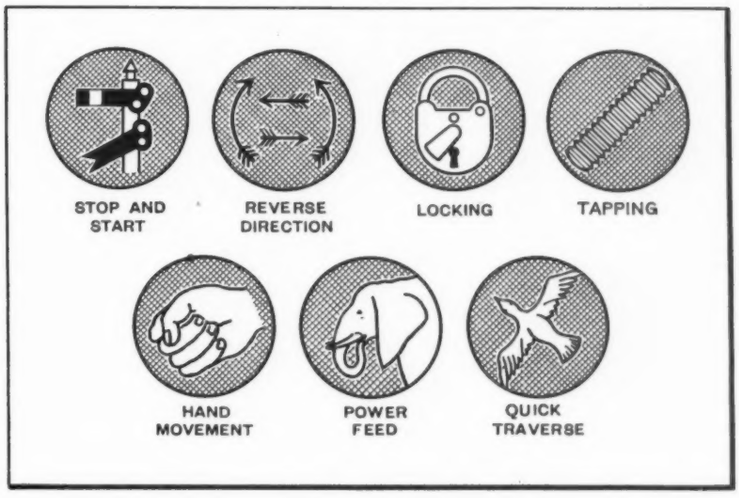


(Left) An Example of Murray Color Control, Applied to a Parkinson Milling Machine

(Right) The Precizer Patented Automatic Size Control Applied to a Lund Cylindrical Grinding Machine



Symbols Employed on Machine Tools in the Murray Visual Color-control System



milling machine; the Drummond Sizemax grinding machine and the Skimax multi-tool high-speed lathe; and the Holbrook Quick-cut high-speed lathe.

The Sizemax grinding machine has an automatic sizing device, the function of which is to operate a fine needle valve, through the medium of a solenoid, so that the feed ceases and the wheel is allowed to "spark out" before returning to the starting position. On the Holbrook Quick-cut high-speed lathe, the normal direction of spindle rotation is reversed, so that the chips from the front cross-slide tools are deflected downward through the bed.

The Herbert No. 4 Senior turret lathe exhibited is representative of the latest design in respect to gear-change facilities. On this machine, provision is made for the selection of the gears necessary to give the desired change in spindle speed while the present speed is still engaged. The change is made instantly by the movement of a single lever. A pre-selective speed change-box is also a feature of the new vertical milling machine demonstrated by James Archdale & Co., Ltd.

Of outstanding interest among the fine boring machines shown was the Krause inverted type. The over-all height of this machine is 2 feet 9 inches, rendering it particularly suitable for cylinder boring. When the machine is not in operation, no parts project above the surface of the longitudinally adjustable work-table. Six spindles are provided, easily removable from or added to the standard frame. They are housed within the bed, operate in an upward direction, and are adjustable for center distance.

The "Color Control" System as Applied to Speeds and Feeds

A number of machine tools exhibited were arranged for the control of speeds and feeds through the medium of colored symbols, following, in the main, a system developed by Murray Colour Controls, Ltd. The use of color to facilitate machine operation is not new. Under the system to which prominence was given at Olympia, however, the use of color is extended to facilitate operations not hitherto considered adaptable to this form of control. So far as the machine tools exhibited and thus equipped are concerned, color control is utilized to indicate the position and purpose of the respective operating levers. The system results in a marked increase in speed of operation. This, combined with simplification, is very pronounced in cases where cutting speed and feed changes are concerned.

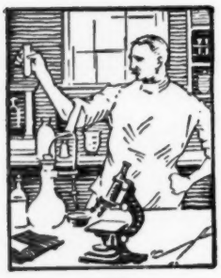
An important feature is that color control entirely eliminates the necessity for speed and feed tables, some of which have been known to incorporate as many as two thousand figures. By using a standard color and symbol, a code is provided whereby the functions of the operating levers on any machine are readily distinguishable. In the system in question, nine colors and seven symbols cover the control requirements of all machine tools. As demonstrated at Olympia color control was applied to turret lathes, planer type milling machines, boring and turning mills, universal milling machines, and boring and facing machines.

A Development in Size Control

While on the subject of controls, mention should be made of the Precizer patent automatic size control with which a cylindrical grinding machine demonstrated by John Lund, Ltd., is equipped. The device is provided with a diamond-pointed finger which contacts with the work. A light ray passing across the inside of the casing is interrupted by the arm of an indicator working in conjunction with a scale. The ray is interrupted as the correct size on the work has been reached, when the oil supply to the feeding mechanism is shut off. A signal light simultaneously warns the operator. On the machine exhibited, the wheel-head was returned to the starting position by hand. By means of a later development, the cycle can be completed automatically, a photo-electric cell operating the machine controls.

The versatility of automatic screw and form-turning machines was a feature of the exhibition, and while most of these were representative only of improvements in various constructional details, mainly in the matter of spindle speeds, special note may be made of the Wickman-Lang three-operation bar automatic. This is equipped with a headstock integral with the bed and has four electrically operated speed changes. The bar-feed member retires during the cutting cycle, thus reducing idle time to the minimum. Three tool-slides, a longitudinal and front and rear cross-slides, are independent and operated by plate cams on a transverse shaft.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

The Part Stainless Steel Plays in the New Automobiles

Two different purposes are served by stainless steel in its application to automobiles. Some parts are made from stainless steel because of the highly decorative effect that it affords. Other parts which are completely hidden from view are made of stainless steel because of its resistance to corrosion and heat.

It is interesting to note some of the many applications of stainless steel on the automobiles of 1935. The following list appears in the *Enduro Era*, which is published by the Republic Steel Corporation, Central Alloy Division, Massillon, Ohio: Cowl trim; tire cover trim; running board molding; grille trim; door handles; medallions; hub caps; radiator caps; lamp-bracket holders; pump shafts; bolts; nuts; carburetor parts; instrument panels; head lamps; bumper and fender guards; and truck bodies.

Molded Plastics that Meet the Demand for High Impact Strength

With the constantly increasing application of molded plastics, demands arise for materials that will meet special conditions. This, for example, led to the development of molding compounds in a great variety of colors, of increased dielectric strength, and of high resistance to water.

Molded plastics intended for use in the manufacture of telephone receivers, football-shoe cleats, instrument cases, cams, etc., must possess greater impact strength than standard compounds. To meet this requirement, General Plastics, Inc., North Tonawanda, N. Y., has brought out two Durez compounds identified as Nos. 1544 and 1547.

The main characteristic of the No. 1544 black compound is an impact strength approximately twice that of ordinary wood-flour filled compounds. As is often the case, the gaining of one quality means the sacrifice of another, and so this doubled impact strength is obtained at the expense of the bulk factor and curing time.

Pieces come from the mold with practically as good a finish as standard materials, and an excellent satin finish can be obtained by sanding and buffing without any of the fillers being exposed. The same grade of compound can be supplied in brown or amber.

The main characteristic of the No. 1547 black compound is an impact strength equal to approximately three times that of standard wood-filled compounds. This increased impact strength is secured at a further sacrifice of the bulk factor, although the curing time in molding is comparable to that of the curing time for the No. 1544 compounds.

A Surfacing Material for Repairing Shop Floors

Concrete, wood, brick, asphalt, or composition floors that have become rutted, rough or broken, can be repaired or completely resurfaced by applying Stonhard Resurfacer, which is a new material being placed on the market by the Stonhard Co., 401 N. Broad St., Philadelphia, Pa. Floors on which this material has been used are ready for truck traffic thirty-six hours after the application. The material provides a tough resilient surface that is waterproof, dustless, and non-skidding. It can be applied with an ordinary trowel and does not require extensive preparation.

An Alloy Steel Developed Especially for Bakelite-Product Molds

The development of a nickel-chromium steel of low carbon content specifically for use in the making of molds for producing Bakelite parts has been announced in *Nickel Steel Topics*, a publication of the International Nickel Co., 67 Wall St., New York City. This new alloy steel is known as Bakadie, and is made by the Braeburn Alloy Steel Corporation, Braeburn, Pa. It is especially suitable for molds in which the impressions are hobbed.

This new alloy steel will take a high mirror finish, and after heat-treatment, it has a surface hardness of from 63 to 65 Rockwell. At the same time, the core is said to be unusually tough. In a compression test on a sample piece 0.380 inch diameter by 0.380 inch long, a load of 41,650 pounds was required to fracture a heat-treated specimen.

Bakadie is an electric furnace product that is melted by tool steel methods which tend to insure uniform quality and freedom from porosity. Its particular qualities are ease of hobbing, an unusually hard case, a tough core, and freedom from volume change during heat-treatment. The core hardness insures good wearing properties under severe conditions and a high resistance to abrasion.

The steel responds readily to heat-treatment and shows deep hardening properties. The producer recommends an annealing temperature of between 1450 and 1500 degrees F., and a carburizing temperature of between 1600 and 1650 degrees F. The length of time that the steel is to be held at the carburizing temperature depends upon the depth of case desired. After a die has been cooled in the carburizing box, it is hardened by quenching in oil at a temperature of between 1475 and 1550 degrees F. The drawing temperature is between 300 and 400 degrees F. In the annealed condition the steel has a hardness of from 128 to 131 Brinell. The steel machines easily.

Koroseal—a Rubber-Like Material that Does Not Soften in Oil

A rubber-like material that does not swell when exposed to many oils and greases or disintegrate in the presence of corrosive chemicals has recently been developed by the B. F. Goodrich Co., Akron, Ohio. This material, which is known as Koroseal, even resists the action of chromic acid and hot concentrated nitric acid. Although not the same as rubber in chemical composition, it may, like rubber, be varied by compounding methods from a very hard to a soft doughy consistency, and it can be molded into any shape. Koroseal can be produced in a variety of colors and it is odorless.

At present, the prohibitive cost of manufacturing this new material precludes its adoption as a general substitute for rubber, but some of its characteristics seem to render it superior to rubber for certain special applications. It has been found ideal for piston packing because of the tight seal provided in the presence of oil. High resistance to moisture and stability over a wide range of temperature are other advantages.

Laytex—a New Insulation for Electricity

Unusual flexibility, high tensile strength, great resistance to compression, high dielectric strength, and important insulation properties are advantages claimed for a new material placed on the market by the United States Rubber Products, Inc., 1790 Broadway, New York City. This material, which is known as "Laytex," is derived directly from the milk of the rubber tree. Through patented processes, all proteins, sugars, and water solubles are removed so as to eliminate the constituents susceptible to moisture. Elongation tests show that this material has a stretch of 750 per cent and a tensile strength of 5000 pounds per square inch.

Pancake Bus Engines Made of Nickel-Chromium Cast Iron

One of the features of the buses now built by the White Motor Co., Cleveland, Ohio, for city transportation is the use of a twelve-cylinder engine in which the cylinders are opposed horizontally. This engine is of such a flat design that it has been termed "Pancake."

The *Nickel Cast Iron News*, published by the International Nickel Co., 67 Wall St., New York City, points out that the cylinder blocks, manifolds, and other important castings of this new engine are made from a nickel-chromium cast iron that provides high strength in combination with durability and wear resistance.

The application of molded plastics widens constantly. At the left is shown a portable mimeoscope with which ruled forms, line drawings, cartoons, etc., can be easily reproduced by the mimeograph process. The device is set in a frame of molded Bakelite. At the right is a foot switch that controls the operation of hospital equipment. The housing of this switch is molded from black Durez.

Machinery and Allied Products Institute Prepares to Measure Pent-Up Business

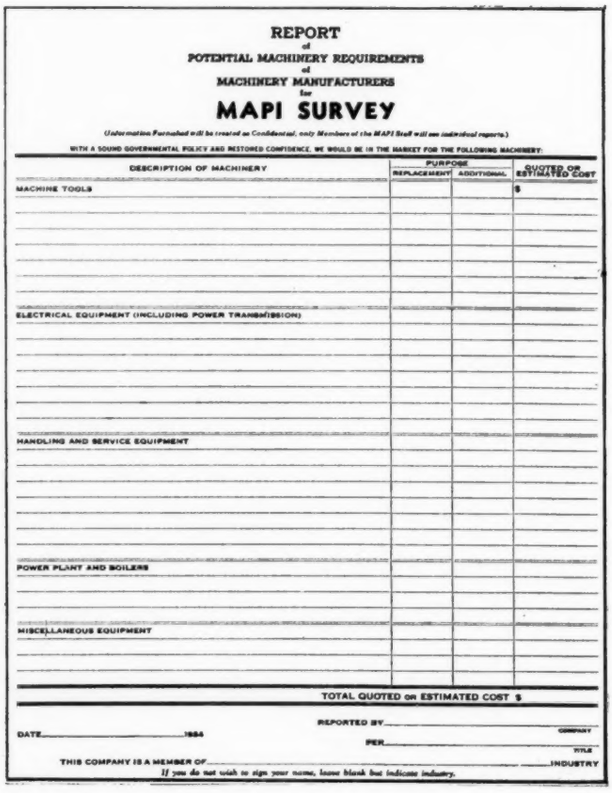
THE Machinery and Allied Products Institute announces the inauguration of a survey of the need for plant replacements and additions of machinery and equipment in American factories which has resulted from the cessation of buying during the five depression years since 1929.

Various estimates have been made, based mainly on speculation. The object of the new survey is to remove the speculative element as far as possible, and by measuring the requirements of a limited, though fairly large, number of representative companies in the capital goods industries, to find an accurate basis for computing the volume of pent-up orders throughout those industries as a whole.

As a start, the Institute has distributed confidential report forms to its members in the machinery industry who normally do a $750,000,000 business annually. Replies are now coming in to the Washington office of the Institute. Approximately 95 per cent of the several hundreds of responses already received assert that replacements will be made as soon as it is clear that business confidence has been restored and credit re-established. Individual estimates of the replacement needs range from a few thousand dollars in small plants to several hundred thousand dollars in some of the larger plants; in the case of one company this figure ran up to $1,000,000, and in another to $2,000,000.

First returns thus disclose the presence of a large amount of delayed business, awaiting only clear indications of better times to be translated into actual orders, with resultant re-employment and acceleration of business all along the line through transportation to raw materials.

The second step undertaken by the Institute is the enlistment of the cooperation of other national trade organizations in making the survey. Letters have been sent to such outstanding groups as the manufacturers of farm machinery, electrical machinery, fabricated metal, and the graphic arts industries, requesting their aid in measuring the dammed-up machinery demand in their fields. With the help of these organizations, the basis for the projected measurement of the pent-up demand will be broadened correspondingly.



REPORT
of
POTENTIAL MACHINERY REQUIREMENTS
of
MACHINERY MANUFACTURERS
for
MAPI SURVEY

(Information Furnished will be treated as Confidential, only Members of the MAPI Staff will see individual reports.)

WITH A SOUND GOVERNMENTAL POLICY AND RESTORED CONFIDENCE, WE WOULD BE IN THE MARKET FOR THE FOLLOWING MACHINERY:

DESCRIPTION OF MACHINERY	PURPOSE: REPLACEMENT	PURPOSE: ADDITIONAL	QUOTED OR ESTIMATED COST
MACHINE TOOLS			$
ELECTRICAL EQUIPMENT (INCLUDING POWER TRANSMISSION)			
HANDLING AND SERVICE EQUIPMENT			
POWER PLANT AND BOILERS			
MISCELLANEOUS EQUIPMENT			
TOTAL QUOTED OR ESTIMATED COST $			

REPORTED BY _____ COMPANY

DATE _____ 1934 PER _____ TITLE

THIS COMPANY IS A MEMBER OF _____ INDUSTRY

If you do not wish to sign your name, leave blank but indicate industry.

Form Used for Machinery Survey

When the work is completed, the Institute hopes to be in a position to announce a fair estimate of the total volume of prospective orders for machinery and equipment in the capital goods industries. By measuring the actual demand of several thousand representative companies, it is believed that it will be possible to chart, with reasonable accuracy, the requirements of the 150,000 companies engaged in the production of all durable goods.

The early returns are almost unanimous in indicating that the prospective demands for machinery will run into tens of billions of dollars. For five years, replacements, in the main, have lain dormant. Until 1930, industry absorbed $8,000,000,000 worth of new machinery annually. Since 1930, the volume has declined to some $2,000,000,000. The tenor of replies bears eloquent testimony to the prevailing belief that the capital goods industries have been hit as hard by the depression as any other line of American enterprise.

Responses received by the Institute thus far disclose that, in many plants, worn-out and non-pro-

ductive machinery is occupying valuable space; that rapid deterioration has occurred in many others closed down; that a considerable proportion of the machinery operating with fair return to owners in 1929 has become obsolete since then; and that new methods of factory management forced into being by the competition of depression years are now calling for new machinery to replace that outmoded since the depression began.

The belief also is voiced in many replies that not only will extensive replacements be necessary for the new competition, but that generous additions to plant machinery will be essential when demand for capital goods swings into the stride of near-normal times. Analysis of early responses discloses a wide spread in requirements, with machine tools, power plants, and power transmission equipment frequently mentioned. Handling and service equipment, boilers, and an extensive range of varied machinery likewise are covered.

There are other factors, of course, whose operation will make for the translation of this potential demand into orders or will tend to continue the delay. One of these is the extent to which credit for making needed purchases is available. Another is the Governmental policy as to taxes and new legislation. An accurate estimate of the prospective demand, however, based on actual requirements of representative plants, is regarded as of primary importance; and this, the officials of the Machinery and Allied Products Institute believe, will be made available soon through the current survey.

The Measuring of Surface Finish

A Brief Review of Methods of Inspecting and Measuring the Finish on Metal Surfaces

AT the production session of the annual meeting of the Society of Automotive Engineers in Detroit, E. J. Abbott, research physicist at the University of Michigan, read a paper entitled "What is Surface Finish and How Can it be Measured and Specified?" Mr. Abbott pointed out that a number of factors enter into the measurement of surface finish; the most important of these are the size and shape of the irregularities that cause the "roughness" of the surface.

Several means have been suggested for rating surfaces, but the author stated as his belief that there is only one method of measurement known that gives the essential data on the size and shape of the irregularities. This is the profilograph method, which enables one to obtain an enlarged record of the surface profile. Briefly, the profilograph is an instrument for tracing over the surface with a very sharp diamond point and magnifying and recording optically the movements of the point as it passes over the irregularities of the surface. In this way, an enlarged record of the profile of the surface is obtained.

The General Appearance of a Finished Surface

One of the interesting facts brought out by the use of this instrument is that the irregularities or scratches in finished surfaces are generally extremely blunt. For example, the width of a hill or valley is often from ten to fifty times its height or depth. This seems to be a fairly general characteristic of all surfaces measured. This fact should be borne in mind when talking about "bending over the peaks." Even if there were actual peaks to be bent over, they would not fill the intervening valleys. This dullness, the author says, is perhaps more easily understood when one considers the difficulty of maintaining tools that are sharp or pointed in terms of tenths of thousandths of an inch.

A second feature of machined surfaces is the wide range in the size of the irregularities. The depth of the irregularities may be a thousand times greater in a rough-bored surface, as compared with lapped piston-pins or gages.

A third feature brought out in examining the finish of surfaces is the wide range in the shape of the profiles of the irregularities. On many surfaces, no two of the irregularities are alike, and their size may vary as much as 10 to 1 in a distance of a few thousandths inch. Hence, records of surface finish that cover too small a length of a specimen are of slight practical value. It has been found that by tracing over 1/4 inch of the surface, a good rating can be obtained on most surfaces, and on fine-finish operations, even a shorter "tracing" is sufficient.

Suggested Method of Specifying Finish

It would seem desirable to specify the roughness of a surface by a single number, so that the surface could be rated, say, as a No. 6 or a No. 10 finish. At first thought, it seems that a number giving the height of the profile would serve this purpose, but an inspection of the profiles of actual surfaces proves that this is not the case. From the standpoint of wear, a surface that is essentially flat, with occasional scratches, is obviously far supe-

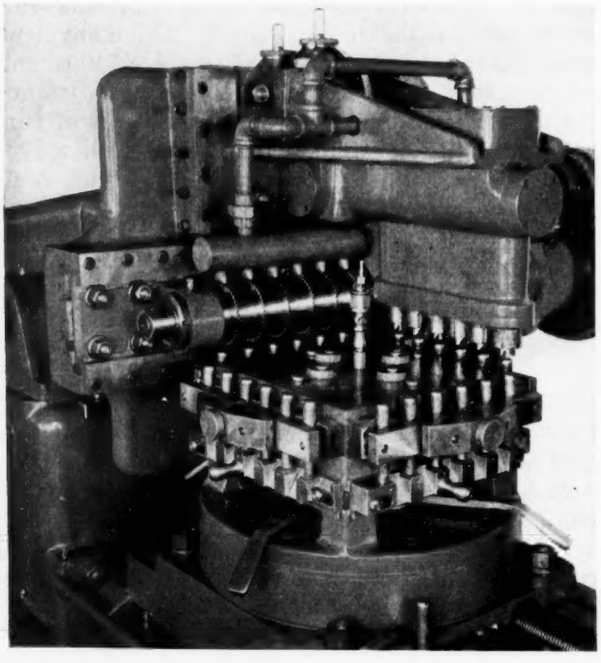
rior to one of sawtooth contour, even though the scratches in both may have the same total depth. Hence, a composite method has been developed, based upon the rate at which the bearing area of the surface is increased as the upper part of the profile is removed.

Inspecting Finish for Different Purposes

A number of methods have been proposed for inspecting or "rating" finish. The profilograph method is excellent for the accurate information that it gives; but it requires a good deal of time, and hence is rather a laboratory device. The minute dimensions involved demand a delicacy of instrument, of adjustment, and of manipulation, which precludes the immediate application of this method to routine factory inspection. For practical application, the author believes that what is known as the "electrical pick-up" method is probably the most practical instrument for routine inspection. This method consists, briefly, of drawing a phonograph pick-up across the surface and using the generated voltage as a measure of the roughness or smoothness.

The old "eye-and-finger-nail" method of judging finish often leads one far astray, especially if different types of finish are being compared, such as ground, lapped, and honed surfaces. This method cannot be depended upon for such a purpose. On the other hand, if one has several specimens produced by a single operation, as, for example, ground parts of varying degrees of roughness, the comparative degree of roughness can be judged by ordinary visual inspection.

For preliminary decisions as to the relative finish obtained by different operations or by different types of machines, or by the use of different tolerances, the only reliable instrument is the profilograph. For routine inspection, a visual comparison can be made between the ordinary production finishes and the standard specimens that have been adopted on the basis of results obtained with the profilograph.



Hollow-milling and Slotting from 1200 to 1400 Pieces of Cold-rolled Steel an Hour on a Producto Machine Co.'s Producto-Matic. The Entire Cutter-spindle Assembly Travels Vertically Only. Each Station of the Fixture is Unloaded by Simply Moving a Handle.

* * *

Electron Calculations Run into Big Figures

The following information pertaining to electrons has been furnished by Theodore Schou, consulting engineer of Fairbanks, Morse & Co., Beloit, Wis. Mr. Schou states that it has been estimated that it would take all the inhabitants of the earth, counting night and day at the highest rate of speed possible, two years to count the number of electrons that pass through an ordinary incandescent electric lamp in one second. The actual number is simply inconceivable, but it may be of interest to note that the number of electrons per second that are equal to one ampere are expressed by the figures 628 followed by sixteen ciphers. It has further been estimated that if 2 grams (approximately 30 grains) of electrons could be collected and pressed into two spheres, each weighing 1 gram, and if these spheres were held 1 centimeter (approximately 3/8 inch) apart, they would repel each other with a force in tons expressed by the figure 32 followed by twenty-five ciphers.

One of the greatest promises of the electronic tube lies in solving the problem of direct-current transmission. With electronic tubes it is not only possible to convert alternating current into direct current, but also to get high-voltage direct current from alternating current. The fact that an electron current could be established through and by a vacuum tube was first discovered by Edison, while Fleming, an Englishman, made the first practical use of the phenomenon in 1897.

In 1906, DeForest made the important discovery of a grid-controlled tube forming a three-element tube, thereby making possible the radio, long-distance telephone, sound pictures, and the electronic industry.

Although the space between the cathode and the anode in a vacuum tube is very small, the electron is proportionately so much smaller that it is estimated that the ratio between the dimensions of an electron and the distance from cathode to anode is about the same as the diameter of a baseball in relation to the distance from the earth to the moon.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Grinding Wheels

NORTON CO., Worcester, Mass. Booklet containing a fund of information on the selection and use of grinding wheels. The booklet describes the abrasive and bonds used and gives information on grain size, grade, and structure. The fundamental factors governing the selection of wheels are outlined and operating rules and general data are included. Complete tables of grinding wheel recommendations for various classes of work are given, as well as a table of speeds for wheels of different diameters.

Horizontal Boring and Drilling Machines

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Illustrated folder, with specifications, outlining the versatility of the Ryerson line of horizontal drilling, boring, and tapping machines. The bulletin explains how the wide range of the machines and the fundamental principle of the revolving work-table permit the handling of large, bulky pieces, as well as the regular run of work, at a great saving in set-up time.

Rubber Belting, Hose, etc.

B. F. GOODRICH CO., Akron, Ohio. New book of engineering data, designed to simplify the selection of belting, hose, and other mechanical rubber goods for industrial service. The section on transmission belting contains a discussion of the relative merits of rubber and leather, a review of belting requisites for a wide variety of uses, and helpful tips on installation procedure. Information is included on conveyor belting, hose, packing, and other products.

Diamond Dressing Tools

KOEBEL DIAMOND TOOL CO., 1200 Oakman Blvd., Detroit, Mich. Circulars describing three different types of Koebel diamond dressers, namely, the multi-edge diamond dresser—a chisel-edge tool for any straight-faced wheel; the multi-point diamond dresser for all straight-face dressing, especially where high finish is desired; and the multi-set diamond dresser for either straight-face or form dressing. Price lists of the different styles are included.

Pneumatic Wrenches

INGERSOLL-RAND CO., 11 Broadway, New York City. Bulletin announcing the new Ingersoll-Rand Pott impact wrench, a pneumatically operated tool so designed as to be especially applicable to difficult jobs, such as removing frozen nuts, etc. The features of construction that give this tool its unusually powerful turning effect are described, and various applications are illustrated.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletins GEA-1450B, 2024, and 2044, illustrating and describing, respectively, single-stage steam turbines for mechanical drive; multi-stage condensing and non-condensing steam turbines; and multi-stage condensing or non-condensing steam turbines. Bulletin GEK-86, descriptive of the General Electric metal-enclosed switchgear and its advantages in reducing switching costs.

Elastic Stop-Nuts

ELASTIC STOP NUT CORPORATION, 1029 Newark Ave., Elizabeth, N. J. Catalogue describing the principle of design of the "elastic stop-nut" and its application. Numerous illustrations show typical applications of these nuts in a diversified number of industries, including the aeronautical, mechanical, electrical, and railway fields. Tables are included giving price lists and dimensions of the different sizes and styles.

Automatic Tool-Room Machines

PRATT & WHITNEY CO., Keller Division, Hartford, Conn. Catalogue describing in detail the operating principles, construction and wide range of application of the Keller automatic tool-room machine. The illustrations show the machine in operation on actual jobs of a wide variety. A table of specifications is included.

Speed Reducers

EARLE GEAR & MACHINE CO., 4709 Stenton Ave., Philadelphia, Pa. Catalogue covering the Earle line of gears and speed reducers. In addition to general specifications, complete tables of nominal ratings are given. For convenience in ordering, tables giving number of teeth, pitch diameter, face, and bore of bevel, spiral, herringbone, and worm gears are included.

Electric Motor Brushes

OHIO CARBON CO., 12508 Berea Road, Lakewood, Ohio. 64-page booklet entitled "The Brush Phase of Motor Maintenance," dealing in a simple way with the causes and effects of sparking, excessive wear, etc., of brushes, commutators and slip-rings of direct- and alternating-current motors and generators.

Machine Tools

MORTON MFG. CO., Muskegon Heights, Mich. Bulletin 25 D, covering Morton Draw-Cut machine tools for railroad shops. Bulletin 26 D, dealing with Morton Draw-Cut machine tools for industrial shops. These circulars show pictorially the advantages and typical applications of these machines in their respective fields.

Paints

SHERWIN WILLIAMS CO., Cleveland, Ohio, is issuing a house organ known as "Paint," which is devoted to paints, painting problems, and painting practices. This publication will be distributed regularly, and will contain many suggestions and

valuable information for the user of paint, especially in the industrial field.

Welding Equipment

AIR REDUCTION SALES CO., Lincoln Bldg., 42nd St., New York City. Leaflet describing the Airco shielded-arc electrodes Nos. 78, 79, and 81 and the class of work for which each type is suitable. Recommended current values for various positions and diameters of electrodes are given.

Perforated Metals

MANHATTAN PERFORATED METAL CO., INC., 43-17 Thirty-seventh St., Long Island City, N. Y. Circular illustrating the different styles of perforated metals in brass, copper, Monel metal, stainless steel, zinc, aluminum, fiber, steel and tin plate made by this company.

Spring Winding Tools

JOHN BLANER CO., 629 Meek St., Sharon, Pa. Leaflet illustrating the various types of hand universal spring winders made by this company and describing the work for which each is especially suited. Instructions for using these tools and prices are included.

Welding Machines and Accessories

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin GEA-1440C, illustrating and describing GE improved Type WD electric arc welders. Bulletin GEA-1546B, containing information on GE welding electrodes and accessories.

Pyrometers

C. J. TAGLIABUE MFG. CO., Park and Nostrand Aves., Brooklyn, N. Y. Bulletin 1101, illustrating and describing in detail the construction features and advantages of a new line of Tag potentiometer pyrometers with high-speed photo-electric action.

X-Ray Service

ST. JOHN X-RAY SERVICE, INC., 30-20 Thomson Ave., Long Island City, N. Y. Leaflet entitled "A Unique Record—Ten Years of Pioneering Experience," showing the progress of X-ray inspection in industry during the last ten years.

Magnetic Clutches

MAGNETIC MFG. CO., Milwaukee, Wis. Bulletin 200, descriptive of a portion of the standard line of multiple-disk magnetic clutches made by this concern. Complete specifications are included on sizes from 6 inches in diameter up.

High-Speed Steel Tool-Holder Bits

FIRTH-STERLING STEEL CO., McKeesport, Pa. Circular outlining the advantages and listing the standard sizes and prices of Circle C and Blue Chip high-speed steel tool-holder bits.

Steels

UNION DRAWN STEEL CO., 232 Harsh St., Massillon, Ohio. Circular containing a list of Union drawn steels and a map showing the location of sales offices and warehouses throughout the country.

Malleable Iron Castings

CHAIN BELT CO., 1600 W. Bruce St., Milwaukee, Wis. Circular illustrating typical examples of Rex malleable iron castings. Samples of Rex gray iron castings and Rex Z-metal castings are also shown.

Welding Machines

LINCOLN ELECTRIC CO., Cleveland, Ohio. Welder Specification Bulletin No. 308, illustrating and describing the Lincoln alternating-current, motor-driven Types SAC300 and SAC-500 "Shield-Arc" welders.

Centrifugal Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletins W-312-B2A, W-312-B3A, and W-312-B4, describing Worthington single-stage volute centrifugal pumps of various types.

Stainless Steel

FIRTH-STERLING STEEL CO., McKeesport, Pa. Circular containing information on the physical properties, heat-treatments, and applications of Sterling stainless steels of different compositions.

Electroplating Equipment

UDYLITE CO., 1651 E. Grand Blvd., Detroit, Mich. Bulletin describing the Udylite rheostat for electroplating processes, which is especially designed to function accurately under severe service.

Air Compressors

CHICAGO PNEUMATIC TOOL CO., 6 E. 44th St., New York City. Bulletin 728, giving complete details of a newly designed line of horizontal single-stage Type T compressors.

Compressor Equipment

INGERSOLL-RAND CO., 11 Broadway, New York City. Bulletin 9212, illustrating and describing the various types of Ingersoll-Rand aftercoolers for air or gas compressors.

Rope Drives

GATES RUBBER CO., 1524 S. Western Ave., Chicago, Ill. Leaflet describing the construction of the Gates Vulco rope drive—a V-belt with a patented concave side.

Rotary Pumping Units

GEROTOR MAY CO., 48 Woerd Ave., Waltham, Mass. Pamphlet descriptive of the Gerotor mechanisms and their application in rotary pumps, gas compressors, meters, etc.

Optical Measuring Instruments

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Pamphlet descriptive of equipments for dark-field microscopy.

* * *

A Convenience for Handling Oil Barrels in the Shop

A convenient rack that enables one man easily to place drums and barrels into position for draining oil into smaller receptacles has been developed and is marketed by the Barrett-Cravens Co., of Chicago, Ill. This device, which is shown in the accompanying illustration, is known as the Rockerack. The action is obvious from the illustration. It is made in two styles—a plain type without casters, and another type with casters—both types being capable of handling barrels and drums containing from 30 to 55 gallons.

Convenient Rack for Handling Oil Barrels

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

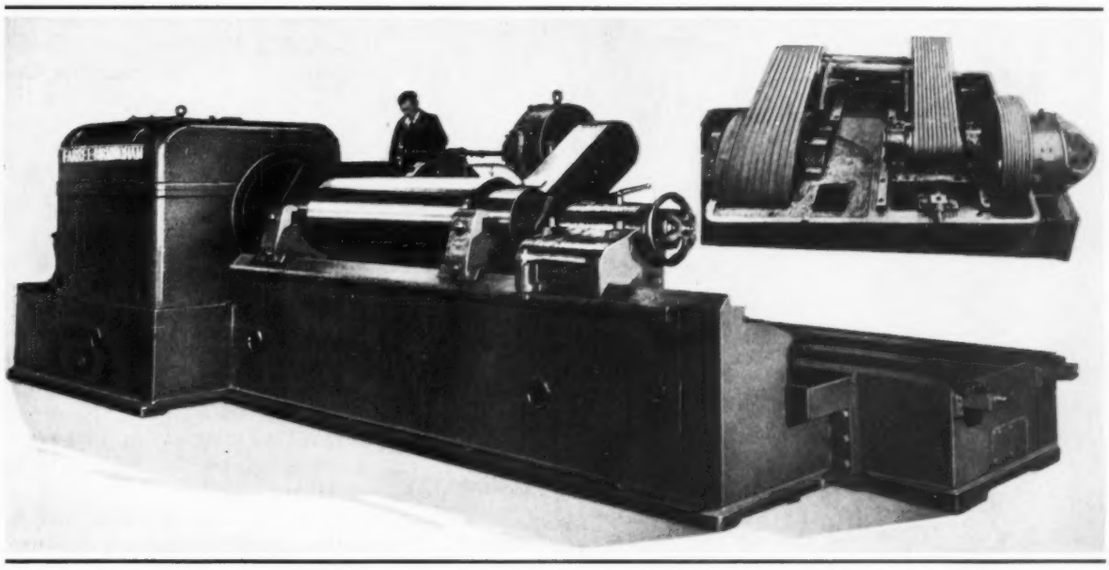
Farrel Heavy-Duty Roll-Grinder with V-Belt Drive

Metal strip and sheet material used in the fabrication of automobile bodies, refrigerator cabinets, furniture, etc., must be rolled with a high finish free from any marks that would impair the smoothness of lacquer coatings. The grinding machine used in finishing rolls for such operations should therefore be capable of producing the finest of mirror-like finishes on the rolls. This machine should also be capable of taking heavy cuts in rough-grinding and of refinishing rolls in the shortest possible time.

With these objectives in mind, the Farrel-Birmingham Co., Inc., Ansonia, Conn., has recently built the 36-inch by 12-foot roll-grinder here shown, which is equipped with a multiple V-belt drive for rotating the rolls. Several machines so equipped have given especially satisfactory results. In one steel mill, rolls that formerly required from five to six hours are now being finished in two hours with a surface free from marks of any kind.

The headstock drive on the machine illustrated is self-contained in a cast-iron case, mounted on the front bed. Three multiple V-belt drives, as seen in the inset of the illustration, reduce the speed of the motor to provide a range of roll speeds from 11 to 44 revolutions per minute. The motor speed is from 300 to 1200 revolutions per minute. Timken precision type bearings are provided throughout the drive, including the bearing that supports the large faceplate pulley. The bearings are mounted in adjustable housings. All three multiple V-belt units can be adjusted separately to obtain the proper tension on the belts without the use of idler pulleys.

An improved flexible faceplate equipped with a balanced self-equalizing bar that has adjustable rubber-bushed drive dogs compensates for inequalities in roll wabblers and automatically minimizes any inaccuracies due to minor errors in setting up the roll. The diameter of the grinding wheel has been increased from 30 inches, as on previous machines, to 36 inches, so that with the same wheel surface speed, a slower spindle speed is



Farrel Roll-Grinder Equipped with a Multiple V-belt Drive to Eliminate Vibration and Marking of the Rolls

obtained. This permits a closer fit in the bearings and at the same time makes the bearings cooler running.

Other standard features of Farrel grinders have been incorporated in this machine, including a patented cambering device which produces a mathematically accurate curve for a crowned or concave roll; a dead-center headstock and footstock; a water-shedding front bed; centralized controls at the operator's station; flood-lubricated inverted V-ways; and flexible steel covers for the carriage ways and the drive rack.

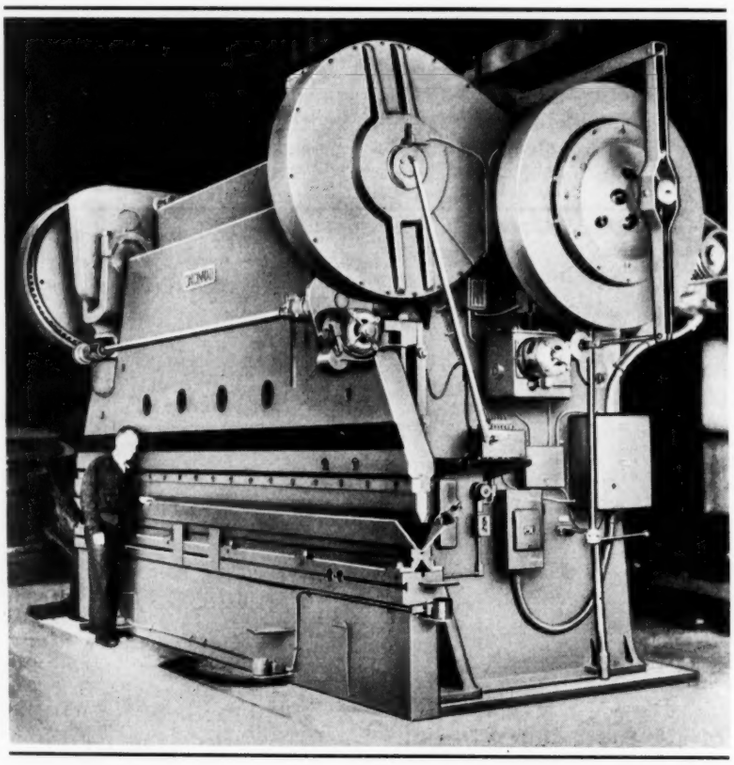
Huge Cincinnati Press Brake

Steel plates up to 18 feet in length by 3/4 inch in thickness, or 12 feet in length by 1 inch in thickness, can be handled by the press brake here illustrated, which is believed to be the largest machine of its type in the world. This machine was built recently by the Cincinnati Shaper Co., Cincinnati, Ohio, for installation in the By-Products Division of the Lukens Steel Co., Coatesville, Pa. It will be used for producing bent, flanged, formed, and multiple-punched plates required by customers of that concern or needed in the manufacture of welded-steel structures by Lukenweld, Inc.

This large press brake is of the characteristic design embodied in the standard Cincinnati line. It has a clear distance between the housings of 12 feet 6 inches and an over-all die length of 18 feet through a 14-inch throat. The ram has a stroke of 6 inches and an adjustment of 6 inches. Independent adjustments are provided at each end of the ram to take care of "fade-out" or cone work.

The machine can be operated at either 5 or 20 strokes a minute. The clutch is hydraulically actuated and is controlled electrically from any of several stations conveniently located. Safe working loads up to 1000 tons can be developed. A direct-reading indicator on the right-hand housing shows the load developed during any operation. This indicator also records the heaviest load to which the machine has been subjected at any time.

The housings for this large press brake were flame-cut from two steel plates 8 inches thick, 87 inches wide, and 13 feet 8 inches long. These plates weighed 33,000 pounds apiece. The bed and ram were cut from two steel plates 7 inches thick, 72 inches wide, 18 feet long and weighing 31,000 pounds each. The main drive gears are also of welded-steel construction, a high-carbon steel being used to provide the required tooth strength and wear resistance in the rims of the gears. The total weight of this machine is about 145,000 pounds.



Huge Press Brake Recently Built by the Cincinnati Shaper Co., which is Believed to be the Largest Machine of its Type in the World

High-Pressure Grease-Gun Control Valve

Pressures in excess of 20,000 pounds per square inch can be developed by means of a Triple S control valve for industrial grease guns, which has recently been developed by the Specialty Sales & Service Corporation, 138 Holden St., Minneapolis, Minn. With such high pressures, lubricant can be forced into bearings, even though they are badly clogged.

This gun-head control valve operates on any grease-line pressure of from 50 to 5000 pounds per square inch; however, a line pressure of from 100 to 1000 pounds per square inch is ordinarily recommended. With a control valve at the end of the high-pressure hose, the pressure can be stepped up in easy and rapid stages to the limits mentioned.

This control valve has been designed particularly for use on all types of power-operated grease guns, barrel pumps, 100-pound drum pumps, etc.

Morton Draw-Cut Flash-Trimming Machine

A high-duty draw-cut machine especially designed for removing the flash from butt-welded steel rings, such as automobile wheel rims, has recently been designed by the Morton Mfg. Co., Muskegon Heights, Mich. This machine, which is shown in the accompanying illustration, will accommodate work having seams up to 12 inches wide and stock thicknesses from No. 24 gage to 3/16 inch.

Power is provided by a motor-driven hydraulic pump. The two rams are reciprocated by means of hydraulic cylinders. Forward and return ram speeds of from 0 to 65 feet a minute are available. The work is placed between hardened dies and sufficient pressure is applied through a hydraulically operated spring-loaded toggle motion to clamp the work securely. Patented vertically adjustable rams and dies take care of the clamping and positioning of the cutters to suit the work. Any variation in stock thickness is automatically compensated for.

The upper ram rises 2 inches, thus providing sufficient clearance for loading and removing the work. As the work is loaded, the operator steps on the control button and then the machine, in sequence, automatically clamps, performs the draw-cut stroke, and releases the work. The cutting tools then return to the starting position.

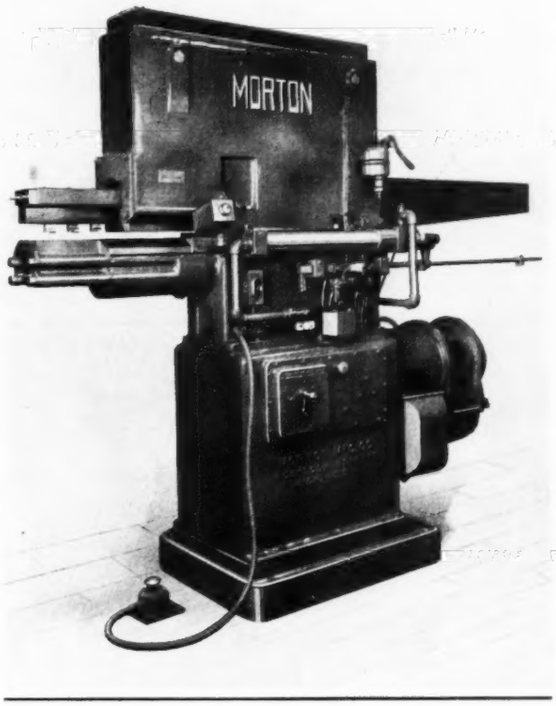
Patented adjustable tool-holders and tool set-ups provide quick interchangeability of the tools, long tool life, and maximum production.

Automatic Brake for Power Presses

In drawing and similar power press operations, it is customary practice to tighten up the simple brakes with which the presses are equipped, in order to overcome the rebound of the rubber bumpers or strong springs used to facilitate withdrawing the die from the work. This tightening of the brakes tends to overload the clutches, produce undue wear and increase the consumption of power considerably.

With a view to overcoming such difficulties, the Fred J. Swaine Mfg. Co., 1300-1306 N. Seventh St., St. Louis, Mo., is making an automatic brake designed to apply the braking action only during that portion of a press cycle when the springs or bumpers are withdrawing the die. During the remainder of the cycle, the brake is released. It is stated that shops using these brakes save 25 per cent of the power previously required to drive the presses and that unnecessary clutch wear has been eliminated.

This automatic brake is adaptable to any make of press, whether new or already in service. Fig. 1 shows a No. 37 inclinable



Morton Hydraulically Operated Machine for Trimming Flash from Butt-welded Rings

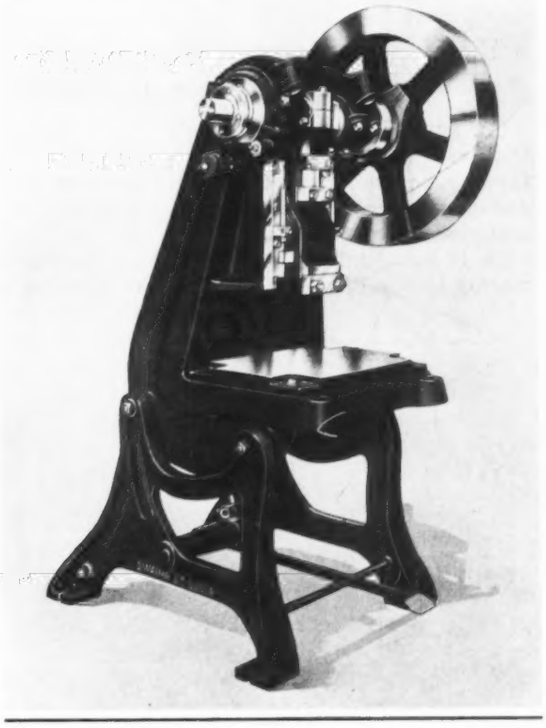


Fig. 1. Swaine Inclinable Power Press Equipped with an Automatic Brake

press built by the company mentioned, equipped with the automatic brake, while the brake itself is shown in Fig. 2.

The brake is mounted on the main shaft of the press and is prevented from rotating by an anchor pin or projection in the press frame. Two lined braking members surround a disk keyed to the press shaft. An approximate setting of these braking members on the disk is accomplished by means of bolts furnished with lock-nuts. The disk is fitted with an adjustable cam which can be rotated on the disk and fastened in any required position by four bolts. The cam tightens the brake only during that portion of the press cycle when the braking action is needed.

This result is accomplished by the cam coming into contact with a roller carried on a short lever. At its right-hand end the lever is keyed to a cross-shaft on which there is a cam that fits into a corresponding cam member in an eye at the lower end of the bolt that holds the two braking members on the central disk. Rotation of the cam on the cross-shaft causes the bolt to be pulled down, thereby tightening the brakes on the disk. An adjusting screw provides for accurately regulating the relative positions of the cam on the disk and the cam-roller on the lever to give just enough braking action to overcome the reaction of the springs or rubber bumpers.

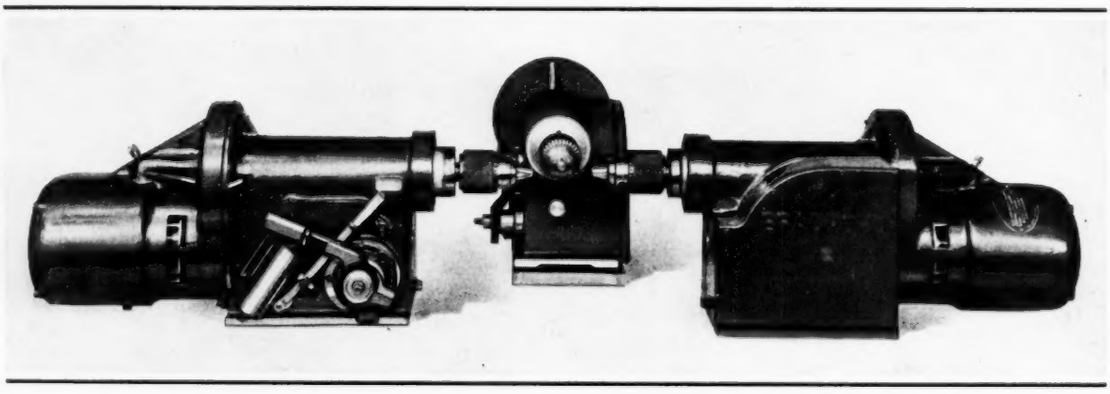
Fig. 2. Automatic Brake for Power Presses

Bradford Automatic Unit for Drilling, Tapping, and Other Operations

An automatic high-speed unit that can be used for drilling, tapping, reaming, spot-facing, and hollow-milling, and that has a capacity for drilling up to 1/2 inch, is being introduced on the market by the Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. Like the larger units made by this concern, the new No. 0 unit was developed for use in building up special high-production equipment. While designed on the same general principles as the larger units, it embodies several new features. For example, the new unit is totally enclosed and runs in oil, being provided with a splash lubricating system that requires no attention except for maintaining the oil level. Anti-friction bearings are used throughout. The spindle and quill are supported both at the front and rear during all portions of the stroke. The construction is such as to maintain spindle alignment.

The stroke of the spindle quill is obtained by a positive-return double-track cam, machined from a solid steel blank. The feed is positively geared and is variable by means of pick-off gears. It is applied through a friction clutch that can be adjusted to slip at any desired pressure for tool protection. Spindle speeds from 525 to 8750 revolutions per minute are available in sixty-three steps by means of pick-off gears. This large range permits the use of very small drills when needed.

This automatic unit can be furnished with any stroke up to a maximum of 2 3/4 inches, and with any feed or combination of feeds within its range. The cycle is automatic and includes a rapid approach to the work, a feed or feeds, a rapid return, and stopping. By merely adjusting a setscrew, the cycle can be made continuous instead of stopping at the end of the rapid return. The standard motor is of the built-in type and has a rating of 3/4 horsepower, but other motors can be furnished.



Three Bradford Automatic High-speed Units that are Applicable for Drilling, Tapping, Reaming, Spot-facing, and Hollow-milling

Ex-Cell-O Hydraulic Power Units

Self-contained compact hydraulic power units applicable for drilling, reaming, counterboring, spot-facing, and similar operations have recently been developed by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. These hydraulic power units are available in three sizes, as follows: A small No. 23 unit with an 8-inch stroke; a medium No. 25 unit with a 10-inch stroke; and a large No. 28 unit with a 12-inch stroke. The units can be mounted in any position, either singly or in multiple, and operated individually or collectively by means of a manual or remote control.

The length of stroke, length of rapid traverse, and length of feed are all adjustable. The rate of feed can be easily changed by means of graduated adjusting valves while the unit is in operation. There are two independent forward feeds. Adjustable dogs control the rapid traverse, the feeds, and the stopping and reversing.

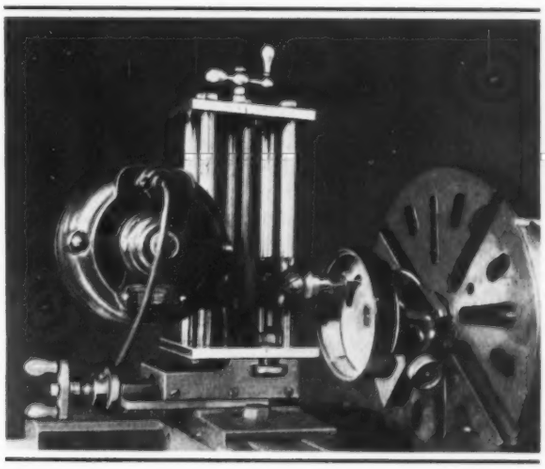
An electric motor drives the hydraulic pump and drive-shaft through V-belts. The pump driving shaft is connected through change-gears to the spindle driving shaft. The latter is splined at the inner end and forms a sliding driver connection with the spindle. The spindle is supported at both the front and rear ends in a quill which carries a piston that is hydraulically operated. By changing the pressure at either end of the piston, the quill is made to move either forward or backward for feeding the unit. Multiple-spindle heads can be attached to the quill if desired.

Ex-Cell-O Hydraulic Power Unit Made in Three Sizes

Milling, Grinding, Broaching, and Drilling Unit for Lathes

A motor-driven unit that can be conveniently applied to lathes for performing milling, grinding, drilling, and broaching operations has recently been placed on the market by the Master Brake & Appliance Co., Inc., Trousdale, Kan. Two sets of mounting holes are provided on the compound rest for this "Lathe Converter," as the unit is called, so that cutting or grinding can be done either parallel with or at right angles to the work. Angular settings of the unit are obtainable by adjusting the compound rest.

In cutting gears, making milling cutters, or performing other operations that require indexing of the work, use is made of the headstock spindle on the lathe. An indexing attachment can easily be made for a standard gear-change lathe by fitting a shaft into the spindle hole at the left-hand end of the lathe spindle. The regular assortment of gears can then be used to obtain a large number of indexing combinations. For quick-change lathes, drilled plates may be necessary instead of the gear assortment.



Equipment that Converts a Lathe into a Universal Machine

The unit is equipped with a 1/4-horsepower motor having a 22 to 1 worm-gear reduction.

Airco Shielded-Arc Electrodes

Shielded-arc electrodes Nos. 78 and 79 are made by the Air Reduction Sales Co., 60 E. 42nd St., New York City, for all classes of steel welding. They are heavily coated electrodes, particularly suitable for welding boilers, high-pressure vessels, tanks, structural frames, bridges, pipe lines, and ships. The electrodes can be used in all positions, that is, flat, vertically, and overhead. The coating insures a quiet arc and a smooth flow of

the molten metal. The speed of welding with the new electrodes is said to be from two to four times greater than with bare or light-coated electrodes.

Welds made with these electrodes have a tensile strength of from 60,000 to 75,000 pounds per square inch and an elongation of from 22 to 30 per cent in 2 inches. The No. 78 electrode is available in all diameters from 1/8 to 3/8 inch, and the No. 79 in the 3/16-inch diameter only. The latter is especially recommended for vertical and overhead work.

The same concern has also brought out a No. 81 heavily coated electrode for flat welding only, which produces welds having the same physical characteristics as those obtained with the No. 78 electrode, except that the elongation usually is about 5 per cent greater.

Cross Gear-Tooth Rounding, Pointing, Chamfering, and Burring Machinery

Three fully hydraulic machines designed for the rounding, pointing, chamfering, and burring of gear teeth are being introduced on the market by the Cross Gear & Machine Co., 3250 Bellevue Ave., Detroit, Mich. All of these machines are designed on the basic principles of previous models, but the mechanisms differ completely. In the new machines, hydraulic prime movers actuate mechanisms that were formerly cam-controlled.

The No. 35 tooth rounder, shown in Fig. 1, is designed to produce any desired shape on the ends of all sizes and types of gears. It can also be used for burring operations, for rounding splines, and for removing the sharp edges and acute corners of helical and spiral-bevel gear teeth.

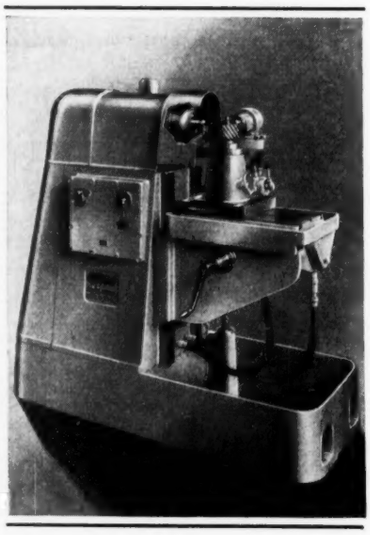


Fig. 1. Cross Fully Hydraulic Gear-tooth Rounder

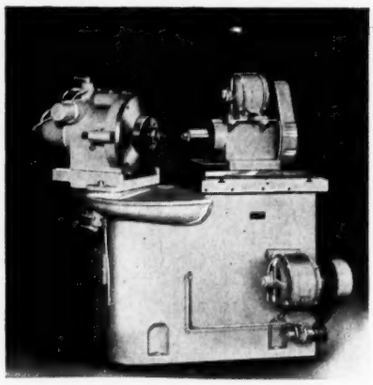


Fig. 2. Machine for Pointing, Burring, and Chamfering Gears

The automatic indexing mechanism of this machine is universal throughout the entire range of the machine. It is quickly and easily adjusted to meet specific requirements. Each tooth is individually located in the correct relation to the cutter, and the gear is always held rigidly during the cutting operation. Set-ups can be quickly made for gears of the same or different pitch.

Gear-tooth pointing machines are available in the No. 40 single-spindle model shown in Fig. 2 and in the No. 41 two-spindle, two-station type. This equipment is primarily intended for pointing the ends of the teeth on synchro-mesh clutch gears and on

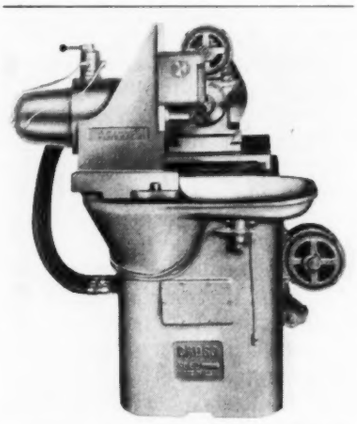


Fig. 3. Gear-tooth Chamfering Machine Made in Single- and Two-spindle Models

spiral and spur sliding gears. However, it can also be used for burring and chamfering operations of certain descriptions. Internal or external teeth can be pointed with equal ease.

Both of these pointing machines employ a hollow mill that is fed in to the stationary work. The automatic mechanism, which is hydraulically controlled, is accurate within 0.0001 inch. A hardened steel tapered plug locates the dividing plate by engaging a hardened steel bushing. Hydraulically actuated work-holding fixtures are built into the machine.

The third type of machine is designed for chamfering the ends of either internal or external teeth on all kinds of gears, as well as for burring operations. This No. 50 machine is built in the single-spindle type shown in Fig. 3 and in the No. 51 two-spindle, two-station type. The cutter-spindles of both machines remain fixed while the work-spindles are movable. While the gears are being rotated, the work-spindles are moved forward and backward by means of guide cams. Each successive tooth is automatically indexed to the cutter. The work and the cutter are never separated, except while loading the machine. Spiral-bevel timing gears are provided. They need not be changed when altering the machine set-up.

Allen-Bradley Solenoid-operated Switch with Dust-tight Enclosure

Allen-Bradley Solenoid-Operated Switches

Sheet-metal enclosures of dust-tight construction, known as Type E, are now available for Bulletin 709 solenoid-operated switches of Sizes 2 and 3, made by the Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. This new line of switches will take care of all polyphase motor requirements up to 15 horsepower, 110 volts; 30 horsepower, 220 volts; and 50 horsepower, 440-550 volts, as well as self-starting single-phase motors.

The new sheet-metal enclosure is black enamel on the outside and has a white enamel interior finish that reflects the light on all terminals, switch parts, and overload relays. This interior finish adds to the ease of installation and inspection. A dust-tight construction is obtained by using a thick felt gasket between the cover and the base.

Type B enclosures of water-tight weather-proof construction have also been developed by this concern to meet the same motor requirements. These switches are suitable for outdoor installations and for use in laundries, pumping stations, tanneries, and other applications where the air is heavily charged with moisture. The enclosure is made of iron castings which are cadmium-plated to resist corrosion. A live rubber gasket between the cover and the base keeps out all moisture.

Type D enclosures have been brought out for solenoid-operated switches used in hazardous dust locations. These enclosures are also of cast iron. The surface between the cover and the base is machined to provide a seal without the need of gaskets.

Hydraulic Torque Dynamometer

A dynamometer of the hydraulic absorption type is being introduced on the market by the Torque Products Co., 875 E. Lake Forest Ave., Milwaukee, Wis. This equipment is intended for use in determining the torque and horsepower of gas, gasoline, oil, or Diesel engines; electric motors; steam and hydraulic turbines; water wheels, speed reducers; brakes; belts, couplings, clutches, etc. The dynamometer can also be used for performing endurance or breakdown tests and for running-in engines.

While new in appearance, the machine is of a basic design developed more than twenty-five years ago. It consists of a stator within which are one or more rotors. The absorption medium is water, and the power is dissipated in heat, under control. Both the stator and the rotor are mounted in annular ball bearings. Scale equipment connected to the floating stator measures the torque that is applied to the rotor shaft in either direction of rotation.

An engine or other unit under test can be running at one end of the dynamometer while another unit is being prepared at the other end for coupling to the dynamometer as soon as the test on the first unit has been completed. This dynamometer is available in various sizes and speeds to meet any requirements.

Torque Dynamometer of Hydraulic Type

Pease "Non-Bleeding" Blueprint Papers and Cloths

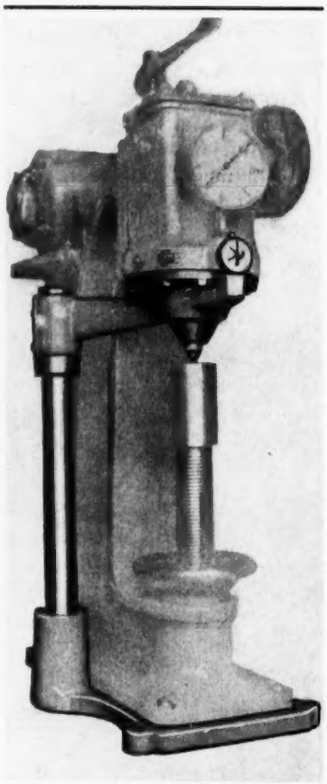
The C. F. Pease Co., 813-821 N. Franklin St., Chicago, Ill., has developed a "K" speed sensitizing solution which is applied to the surface of blueprint paper or cloth to hold the color fast and eliminate "bleeding." It is claimed that this "K" speed solution has discredited the common theory that blueprints are overexposed when the white lines do not show up clear and strong. With the new "K" speed papers or cloths, prints can be overexposed and will still be produced with deep blue areas and pure white lines, standing out clean and clear in sharp contrast. The "non-bleeding" feature is equally advantageous in making blue-line prints. It is not necessary to waste paper or time by blocking out behind each blue-line print.

The unusually wide range of exposure that is permissible with these new papers and cloths enables practically all classes of tracings to be handled at one printing speed. The operator need not worry if he happens to misjudge the correct printing speed. The color-fast feature is particularly important to concerns that use prints day after day in the shop or field, as it obviates the necessity of constantly replacing prints.

These "K" speed papers and cloths are available in all standard lengths, widths, weights, and rag-stock content, as well as in rolls or standard cut sheets.

Direct-Reading Attachment for Brinell Machines

An attachment designed to reduce the cost of testing parts in quantity for hardness has recently been devised by the Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit, Mich. With this device applied to a Brinell hardness testing machine, the operator can check parts without the use of a microscope. In most cases, grinding or spotting is unnecessary, and equally good results are obtained on flat, round, or odd-shaped surfaces.



Direct-reading Device Applicable to Brinell Hardness Testers

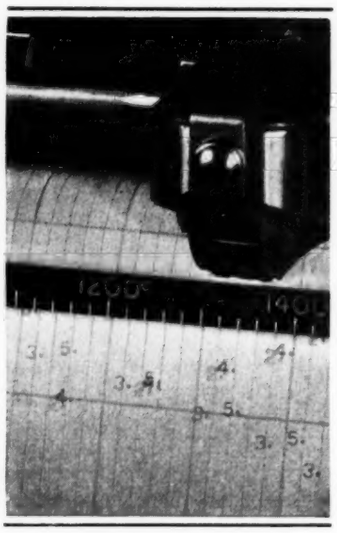
In using the attachment, tolerance hands are set to the desired limits on a dial and the operator merely notes whether or not the pointer stops between the limits. The indicating instrument is supported independently so that errors due to frame deflection or distortion are eliminated. This arrangement makes the device adaptable to all makes of machines, including those with a deep work gap or those of special design.

Although developed primarily for use on power-driven machines, the attachment can also be applied to advantage on hand-operated types when a large number of similar pieces are to be tested. A high degree of accuracy is claimed for the device, and it is stated that tests can be performed at the rate of 600 an hour under favorable conditions.

Multiple-Point Instruments that Record in Colors

The reading of multiple-point instrument records has been simplified by a system of marking the numerals in colors which has been developed by the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. This marking system can be provided on the Micromax strip chart recorders made by the concern for 2, 3, 4 or 6 points.

With each of the thermocouples, resistance thermometer bulbs, or other primary elements identified on the chart by a numeral, and each numeral distinguished from the others by being printed in a contrasting color, the reading of records is made easy, errors are avoided, and time is saved.



Device that Prints Numerals in Color on Micromax Recorder Charts

Black, green, red, violet, yellow, and blue are the colors used in printing the numerals. The illustration shows a close-up view of the printing device and a section of the chart. The printing wheel has a separate ink pad for each point to be recorded.

Electrode for Restoring Worn Cutting Edges

An arc-welding electrode for restoring worn cutting edges on tools of all kinds has been developed by the Lincoln Electric Co., Cleveland, Ohio. By using this Toolweld electrode, lathe tools, bits, milling cutters, drills, cutting and forming dies, and other tools that have become worn in service can be refaced an unlimited number of times. Also, new tools made of ordinary steel in place of high-speed steel can be provided with a suitable cutting edge at large savings.

The Toolweld electrode provides a deposit equivalent to high-speed steel. Although the weld metal as deposited has a hardness of 55 to 65 Rockwell C without heat-treatment, the admixture of base metal with the weld deposit causes the degree of hardness to vary somewhat. In general, the hardness can

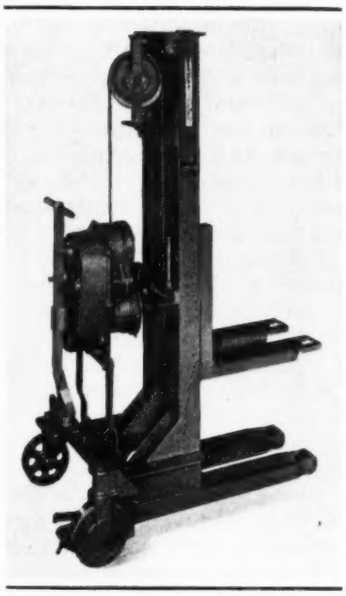
be increased by permitting the deposit to cool slowly and by depositing additional beads of electrode. The deposit can be heat-treated in the same manner as high-speed steel, but at a slightly lower temperature.

In tests conducted with tools having cutting edges built up with this electrode, it has been found that the built-up edges last considerably longer than the original tool steel. The Toolweld electrode is covered with a coating which, as it is consumed in the arc, shields the arc from the atmosphere and thus prevents the formation of oxides and nitrides in the weld metal. The coating also helps to steady the arc and insures a smooth uniform deposit of the weld metal. This electrode is made in 14-inch lengths and in diameters of 3/32, 1/8, 5/32, and 3/16 inch.

Barrett Tin-Plate Elevator

Loads of tin plate weighing up to 4000 pounds can be handled by the portable elevator here illustrated, which is a recent development of the Barrett-Cravens Co., 3255 W. 30th St., Chicago, Ill. This equipment is intended for use with 4-inch pallets or skids. Ball-bearing wheels enable one man to manoeuver loads with ease. The two-speed handhoist, in which all gears run in oil, also facilitates operation.

This elevator has an over-all height of 6 feet 6 inches and a lifting height of 4 feet 6 inches. The lifting arms are 22 inches long. When lowered, the arms are 3 1/2 inches above the floor.



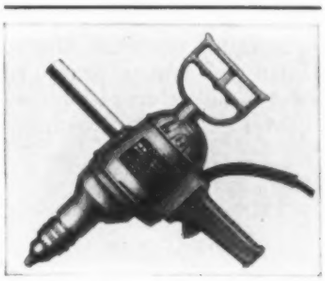
Barrett Tin-plate Elevator for Stacking Applications

Porter-Cable Belt Sander and Grinder

A Type B-12 bench model has been added to the line of belt sanders and grinders manufactured by the Porter-Cable Machine Co., Syracuse, N. Y. This machine employs a 6- by 43-inch abrasive belt for sanding or grinding flat surfaces on metal, wood, composition materials, marble, slate, and stone. It is especially suitable for grinding off burrs, smoothing rough stampings, removing high weld spots, etc. Any belt speed up to 4000 feet a minute can be provided.

Porter-Cable Bench Type of Sander and Grinder

The machine can be supplied with or without a motor and with either flat or grooved pulleys. With the motor mounted at the rear end as shown, the length of the complete equipment is 34 inches. Motors of 1/2 or 3/4 horsepower can be mounted on the standard base. Without the motor, the weight of the equipment is 125 pounds.



Signal One-half Inch Drill with Universal Motor

Signal Portable Electric Drill

A 1/2-inch standard-duty portable electric drill just placed on the market by the Signal Electric Mfg. Co., Menominee, Mich., is here illustrated. This Type OB-5 drill is equipped with a universal motor for operation on direct or alternating current of 110 to 120 volts. The housing is made of an aluminum alloy, the net weight being only 14 pounds. The over-all length of the drill is 16 1/2 inches.

Ball thrust bearings are furnished for the armature and spindle, and heat-treated alloy gears are supplied. The no-load speed is 420 revolutions per minute. The brushes are accessible from the outside. The tool is supplied with a breast-plate handle, a detachable pipe handle, and a trigger switch that can be locked for continuous operation.

"Lionite"—Etched Abrasive Grains

Abrasive polishing grains that are treated by a process which eats into the grains and thus develops small pores that are said to promote fast and keen cutting are being introduced on the market by the General Abrasive Co., 3507 Hyde Park Blvd., Niagara Falls, N. Y. Because the grains are rough, unusual surface adhesion is also obtained. The name "CBT Lionite" has been given to these polishing grains.

The grains are polyhedral in shape, possess high capillarity,

are accurately graded and average over 95 per cent alumina. The new grains have proved successful in severe operations, such as shovel and plow polishing.

Air Hose of Compensated Construction

Air hose so constructed that it does not expand and yet compensates for unequal stresses is being placed on the market by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., under the trade name of "Compensated." In this air hose, unequal ply

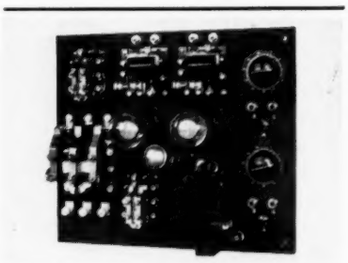
Compensated Air Hose of Rubber and Fabric Construction

stresses set up in the wall by longitudinal and lateral tension incident to operation are compensated for and made equal.

From the illustration it will be seen that the hose consists of an inner oil-resisting rubber tube, which is covered successively by cord braid, a rubber cushion, a fabric strength member that is spirally wound, a second rubber cushion, a second cord braid, and an outer cover that is particularly resistant to wear.

Automatic Repeat Process Timer

A repeat process timer designed for use with a wide variety of electrically operated devices and machines that require automatic timing of the "power-on" and "power-off" periods is a recent development of the Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. This timer is built in four standard sizes for operation on 110-, 220-, 440-, or 550-volt circuits of any standard frequency.



Automatic Repeat Timer for Electrically Operated Equipment

It provides a quick and convenient means of closing an electrical circuit for a definite length of time and then opening the circuit for a similar or different length of time. This cycle of operations is repeated as long as the control push-button or master is closed.

Both the "power-on" and the "power-off" periods are independently adjustable from a minimum of 0.05 second to a maximum of 0.90 second. With both periods set at the minimum time, the device provides for 550 operations a minute.

Cutler-Hammer Safety Switch of Modernistic Design

Modernistic appearance is emphasized in the design of the Bulletin 4140 safety switch being introduced on the market by Cutler-Hammer, Inc., 264 N. 12th St., Milwaukee, Wis. This switch, which has a rating of 30 amperes, is particularly adaptable to oil burners, domestic stokers, air-conditioning equipment, electric unit heaters, and similar equipment.

Thirty-ampere Safety Switch of Modernistic Design

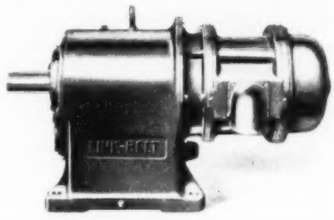
Although the switch measures only 3 1/2 by 5 1/2 by 3 1/2 inches, ample wiring space makes installation easy. To facilitate wiring, the complete mechanism can be removed by loosening two screws, the wires pulled through, and the mechanism replaced. The operating lever is made of a special arc-resisting laminated horn fiber to insure long life. The switch can be padlocked in either the open or closed position. The housing is finished in black enamel with a cadmium trim.

Nicholson File with Curved Milled Teeth

Nicholson Milled Tooth Files

Curved teeth with a rake and clearance selected to insure rapid cutting by shearing off the surface of metals are a feature of the "Superior Brand" files being introduced to the trade by the Nicholson File Co., Providence, R. I. These files are made in both rigid and flexible types. The flexible files are designed for use with special handles on either concave or convex surfaces. They are particularly useful on automobile body work.

Fifteen different designs comprise the new line, including a narrow flexible file intended for use between strips of molding, a square standard-cut file designed for use on keyways, and a half-round standard-cut file which has teeth on the convex side only. The file illustrated is a standard-cut file which does the work ordinarily done by a bastard-cut file. It is especially effective an aluminum castings, babbitt, brass, cast iron, copper, fiber, hard rubber, marble, sheet metal, slate, and wood.



Link-Belt Self-contained Helical-gear Speed Reducer

Link-Belt Motorized Reducers

Motorized helical-gear speed reducers have been added to the line of reducers manufactured by the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill. A particular feature of these speed reducers is the unusual accessibility of the motor and the high-speed gears. A standard round-frame motor is secured to the reducer housing by means of an adapter casting which supports the motor shaft in over-size anti-friction bearings close to the pinion. This insures good alignment and proper meshing of the gears.

The complete motor, with the adapter and motor pinion, can be removed as a unit for inspection or maintenance without disturbing the alignment of the motor or of the gears in the reducer housing. Also, the motor pinion and gear are removable without disconnecting the driven machine or disturbing the low-speed gears.

All gears are of the helical type and anti-friction bearings are provided throughout. The low-speed shaft and its bearings are designed to carry overhung loads. A liberal reservoir provides automatic lubrication of the gears and bearings. Seals at shaft openings retain the oil in the housing and keep grit and dirt out.

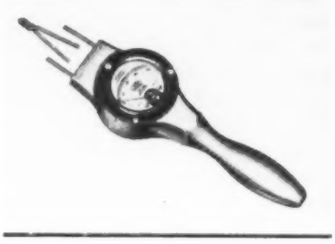
These motorized reducers can be mounted on the floor, ceiling, or wall. They are available in the double-reduction type in ratings ranging from 1/2 to 75 horsepower, and in ratios up to 38 1/2 to 1, and in the triple-reduction type in ratings up to 30 horsepower, and in ratios up to 292 to 1.

Milligan & Wright Blueprint Machine

A blueprint machine that utilizes the Angstrom lamp has been placed on the market by the Milligan & Wright Co., 4616 Prospect Ave., Cleveland, Ohio. The Angstrom lamp operates on regular 110-115 volt alternating- or direct-current lighting circuits without the necessity of transformer choke coils, etc. Another advantage claimed for this incandescent lamp is an unusually high quality of light at the blue end of the spectrum.

The portable Model 100 machine illustrated will print one 18- by 24-inch print, two 12- by 18-inch prints, or four 9- by 12-inch prints at a time. To make a print, it is only necessary to place the tracing and the blueprint paper on the plate glass top, lower the pressure pad, and close the cover. Springs insure good contact between the tracing and the paper. An automatic time switch is then turned on and set to give an exposure of about one minute, the length of the exposure depending upon the paper used. When the time switch clicks off, the print is removed and washed in water and potash solution contained in trays provided for the purpose. The print is then dried.

Portable Blueprint Machine with Angstrom Lamp



Portable Type of "Hold-Heet" Pyrometer

"Hold-Heet" Lance Type Pyrometer

A low-priced portable or lance type of pyrometer that can be supplied with suitable meters for three different temperature ranges is being placed on the market by the Russell Electric Co., 354 W. Huron St., Chicago, Ill. The three temperature ranges are 60 to 800 degrees F., 60 to 1600 degrees F., and 50 to 2500 degrees F.

This instrument is of the same general design as the wall type pyrometer described in April, 1934, MACHINERY, page 508, except that a handle has been provided to enable it to be used conveniently for such operations as checking each melt of non-ferrous metals or for determining the temperature of ovens, furnaces, salt and oil baths, heat-treating machines and processing equipment.

The new pyrometer can also be used as an exploring instrument for gathering heat data in chemical and industrial processes or as a "trouble shooter" and check tester on existing pyrometer installations. Special types of thermo-couples are available for different applications, including a silver disk contactor intended for the quick determination of surface temperatures.

Miniature C-Clamps

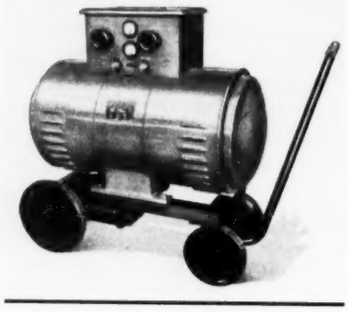
C-clamps with a throat depth of only 1 inch and with openings of 1 and 2 inches have been added to the line of products made by the Adjustable Clamp

Co., 417 N. Ashland Ave., Chicago, Ill. These miniature clamps are made with malleable-iron frames that are cadmium-plated. The foot is ground smooth. The steel screws are tipped with freely turning swivels. A loose-pin handle enables ample pressure to be applied without resorting to pliers, and at the same time, permits the screw to be turned in close quarters.

Noel "Speed-Arc" Welder

The Ideal Electric & Mfg. Co., Mansfield, Ohio, is placing an arc welder on the market which is claimed to have an unusually fast arc and recovery speed. Oscillograph tests show that recovery from short circuit to a normal welding current occurs in less than 0.01 second. Another advantage claimed for this welder is that it will maintain its current and voltage settings when started up cold and run full-load for any desired period. The temperature rise of the machine has no effect on the current and voltage settings.

The welder can be arranged for either 25- or 40-volt operation by simply adjusting the controls. Other features include an all-steel welded construction, a dual control system for both the voltage and current, a polarity reversing switch, and individual current and voltage meters. An automatic brake prevents the welder from rolling when the pulling handle is lifted.

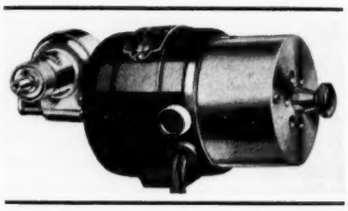


Noel Welder Designed to Give a Fast Arc and Recovery

The welder is available with either an alternating- or a direct-current motor drive or an engine drive.

Dumore Motors with Electric Governors

The advantage of constant speed is combined with light weight in a line of universal governor-controlled motors developed by the Dumore Co., 14th, Racine, and Clark Sts., Racine, Wis. Two types of governors are available on these motors—an adjustable type which provides for varying the speed while the motor is in operation, and



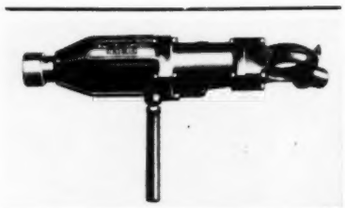
Dumore Universal Motor with an Electric Governor

a fixed type which can be adjusted only when the motor is at a standstill. Three sizes of each type are available for controlling the speed of motors rated at from 1/64 to 1/8 horsepower over a speed range of from approximately 1000 to 7500 revolutions per minute.

These electric governor-controlled motors are especially adapted for operating portable talking motion-picture projectors, scientific instruments, and apparatus requiring quick acceleration. The governor serves to hold the motor speed constant under varying loads, regardless of minor fluctuations in the line voltage.

Ingersoll-Rand Pott Impact Wrench

A small pneumatic tool now being placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York City, will spin



Pneumatic Wrench with a Rotating and Hammering Action

down a 1-inch or larger nut at the rate of 700 revolutions per minute and then give it a series of quick torsional blows at the rate of 1400 a minute to tighten it as securely as desired. This Ingersoll-Rand Pott "impact wrench," as the tool is called, weighs about 20 pounds. It employs a rubber "accumulator" consisting of a cylindrical block of special rubber, interposed between the multi-vane air motor and the chuck. In operation, the torque from the motor is applied to the accumulator. The latter, by twisting, becomes shortened so as to lift the hammer from engagement with the anvil. The hammer is then released and is spun forward to the next engagement, thus delivering a blow with considerable mass behind it to the anvil. The chuck is attached to the end of the anvil.

These torsional impacts exert a powerful turning action that makes it possible to remove nuts which could not otherwise be taken off except by splitting with a chisel or applying a torch. One man can operate the wrench with ease. The accumulator absorbs the torque and eliminates the danger of shock or injury to the operator. The cushioned action makes it possible to employ the impact wrench with safety in difficult positions.

Goggles Designed for Maximum Ventilation

Goggles intended specifically for men working in confined spaces or in departments where the temperature or humidity is high are shown in the illustration. These goggles are a recent development of the Amer-

Goggles for Men Working Under Hot or Humid Conditions

ican Optical Co., Southbridge, Mass., and are known as the "Duralite-50 Hot Workers' Goggles."

An unusually large amount of area is provided for ventilation. This keeps the lenses free from fogging or steaming, and also keeps the area around the eyes cool, preventing perspiration from obstructing the vision. In addition to providing clear and comfortable vision, the goggles furnish a dependable protection for the eyes.

* * *

Weld-O-Meter Gives Useful Welding Facts

A quick reference circular-disk chart known as the "Weld-O-Meter" is being distributed by the Thomson-Gibb Electric Welding Co., Lynn, Mass., free of charge to those interested in resistance welding.

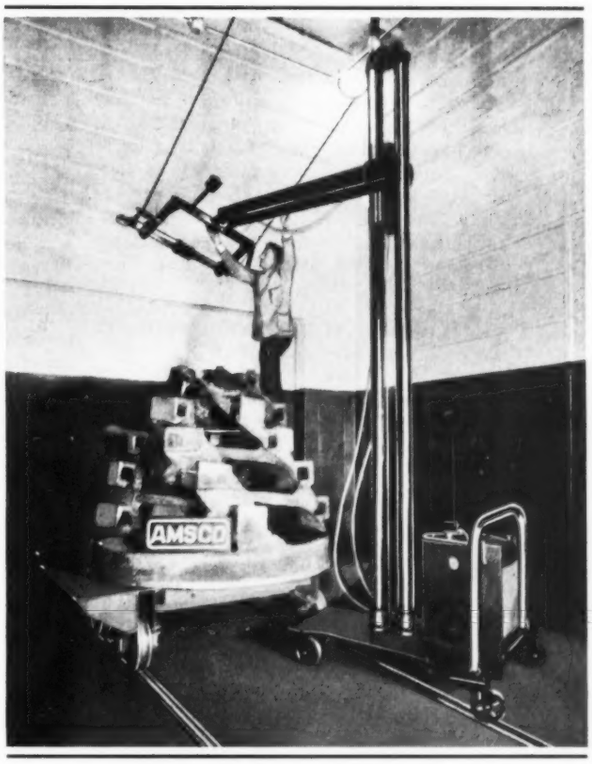
This handy device tells the correct type of equipment and the right control settings to use for spot or flash welding any gage metal at any required production rate. Briefly, it gives full information on time, pressures, speeds, and current consumption of resistance-welding jobs. It should prove a handy aid wherever the resistance-welding process is used.

X-Ray Inspection Equipment in a Steel Foundry

The alloy-steel foundry industry has reached the point where in many cases the correct composition and heat-treatment of a metal for given requirements are definitely known; but soundness of the metal is of as much importance as correct analysis. There must be no internal defects. Here is where the X-ray enters into foundry practice as an inspection tool that will aid in the determination and application of the best possible foundry methods.

With the X-ray it is possible to "see into" the casting to a depth of, say, 5 inches of metal and feel sure that all defects within the area photographed will show up. It is not always possible to produce perfectly sound castings; but it is possible, when the defect is known, to change the design or method of manufacture so that sound castings can be produced continuously. The function of the X-ray is to give the engineer and foundryman "inside information," so that if necessary, they can change their methods in order to overcome the defects encountered.

The American Manganese Steel Co., Chicago Heights, Ill., has recently invested a considerable amount in what is said to be the most efficient and powerful X-ray laboratory now installed in the foundry industry. Since by means of the X-ray, castings can be inspected without breakage and destruction, it is fully expected that the X-ray equipment will pay for itself directly in saved material. It certainly will aid in rendering better service. Of course, all castings made need not be subjected to X-ray examination; but when new and unusual castings are being produced, it makes it possible to perform the inspection in a manner otherwise beyond the reach of the foundryman.



Portable X-ray Equipment of Great Flexibility Installed in the X-ray Laboratory of the American Manganese Steel Co.

* * *

Fewer Sizes of Twist Drills

A proposed American Standard for twist drill sizes, which reduces by 59 per cent the number of sizes now listed by the manufacturers, has been submitted to the American Standards Association by the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the National Machine Tool Builders' Association, all of which have given it their approval. The proposed standard lists 110 twist drill diameters, size 1/2 inch and smaller, which is a reduction of 160 in the present number of sizes.

NEWS OF THE INDUSTRY

Illinois and Missouri

ERNEST E. LEE CO., 53 W. Jackson Blvd., Chicago, Ill., has recently been appointed agent to handle the line of air filters made by the Coppus Engineering Corporation, Worcester, Mass., for air compressors, internal combustion engines, and industrial and ventilating applications.

REVERE COPPER & BRASS, INC., Chicago, Ill., announces the opening of an office at 1511 Telephone Bldg., 1010 Pine St., St. Louis, Mo. EDWARD A. HARBECK, St. Louis district manager, is in charge of the new office.

Michigan

FOOTE BROS. GEAR & MACHINE CO., 5301 S. Western Blvd., Chicago, Ill., announces the appointment of C. A. HAYWARD as sales and engineering representative for the IXL line of speed reducers and gearing in the Detroit territory, replacing G. W. CRAIGHEAD, former representative. Mr. Hayward's headquarters will be at 7310 Woodward Ave., Stormfeltz Lovely Bldg., Detroit, Mich.

PAUL W. RHAME has been appointed assistant manufacturing manager of the AC Spark Plug Co., Flint, Mich. SYDNEY N. LYTTLE has been appointed chief inspector. Mr. Rhame formerly was chief inspector and Mr. Lyttle was his assistant. The office of assistant manufacturing manager is a newly created position.

CARL E. SWIFT CORPORATION, Holland, Mich., has been organized to manufacture electric washing machines and other appliances. Carl E. Swift is president of the new concern, E. G. Landwehr, vice-president and treasurer, and Frank E. Stearns works manager.

New England

NEW JERSEY ZINC SALES CO., INC., 160 Front St., New York City, announces the purchase from the estate of Ralph E. Potter, who was associated with the company for many years, of the business and good will of DAVID RANDALL & CO. This business will be continued under the name of the New Jersey Zinc Sales Co., but for the present will continue to operate at the old location, 55 Kilby St., Boston, Mass. GEORGE W. HARRAGAN, who assisted Mr. Potter while the latter was ill, will continue as New England representative.

JOSEPH GABRIEL, who has resided in Spain for the last two years, has become associated with the Peck, Stow & Wilcox Co., Southington, Conn., as manager of the export division both for the tools and hardware and the machinery division.

New York

J. W. SANDS, of the development and research department of the International Nickel Co., Inc., 67 Wall St., New York City, was the guest speaker at the January meeting of the Worcester Chapter of the American Society for Metals. Mr. Sands discussed the value of nickel in increasing the fatigue resistance as well as in accentuating the toughness of steel; the increase in depth hardening qualities of nickel steel over those of plain carbon steel; and the ability of nickel to increase the fatigue-tensile ratio of heavy or intricate steel sections which are not amenable to quenching and tempering treatments.

IVAN V. BOYEV, the new chairman of the board of directors of the Amtorg Trading Corporation, recently arrived in New York from abroad to assume his new duties. Mr. Boyev was formerly Vice Commissar for Foreign Trade of the Soviet Republics, in charge of Soviet purchases abroad. He has also, at various times, been a member of Soviet trade delegations to foreign countries. A. J. Rosenshein, acting chairman of the board, will resume his position as president of the Amtorg Trading Corporation.

J. S. VANICK, of the development and research department of the International Nickel Co., Inc., 67 Wall St., New York City, spoke before the New Jersey chapter of the American Society for Metals at the January meeting. The subject of Mr. Vanick's address was the hardening of cast iron. G. F. GEIGER, also with the International Nickel Co., was guest speaker at the January 17 meeting of the Springfield Engineers Club, Springfield, Ohio. Mr. Geiger discussed the applications of nickel alloys.

S. V. TRAVIS has been appointed manager of the generator and converter division of the central station department of the General Electric Co., Schenectady, N. Y., succeeding G. F. Brown, who died late in November. C. K. SKINNER has been appointed designing engineer of the home laundry equipment section, and C. O. HULL, designing engineer of the wire and cable section of the merchandise department of the General Electric Co. at Bridgeport, Conn.

WILLIS R. WHITNEY, vice-president in charge of research for the General Electric Co., Schenectady, N. Y., was awarded the Edison medal for 1934 by the American Institute of Electrical Engineers at the winter meeting in New York. The medal was awarded Dr. Whitney "for his contributions to electrical science, his pioneer inventions, and his inspiring leadership in research."

PORTER-CABLE MACHINE CO., Syracuse, N. Y., writes us that the company has had a 40 per cent increase in business for 1934, as compared with the previous year. This is the largest volume since 1931. The company's representatives in all parts of the country have reported an improvement in business confidence.

SEAMLESS STEEL EQUIPMENT CORPORATION, 39 Broadway, New York City, has taken over representation in the United States for the HYDRAULIK G.M.B.H., of Duisburg, Germany, manufacturers of hydraulic compressed air accumulators and hydraulic presses.

J. R. SCHUCHARDT has been appointed sales engineer in the metropolitan district of New York for the Advance Pressure Castings, Inc., 34 N. 15th St., Brooklyn, N. Y. GEORGE A. MEYER has been made production manager and purchasing agent of the concern.

DR. ERNST F. W. ALEXANDERSON, consulting engineer of the General Electric Co., Schenectady, N. Y., noted for his contributions to radio, has been elected to membership in the Royal Academy of Science of Sweden.

Ohio

AMBROSE SWASEY, dean of American machine tool builders, recently presented gold watches to two veteran employes of the Warner & Swasey Co., Cleveland, Ohio, CHARLES A. MILLER, a machine designer, and GEORGE P. RITTER, a tool-room lathe operator, in honor of their twenty-five years' service with the company. The custom of presenting watches to men who have been in the company's employ for a quarter of a century was inaugurated in 1920, on the company's fortieth anniversary. These men were the fifty-eighth and fifty-ninth to be so honored.

PAUL W. GREGORY has been appointed general manager of the Canton Culvert Co., Canton, Ohio, a subsidiary of the Republic Steel Corporation, Youngstown, Ohio. Mr. Gregory succeeds F. A. Kelly, who was recently appointed president of the Toncan Culvert Manufacturers' Association, Youngstown, Ohio, and head of the Republic Steel Corporation's culvert division.

JOSEPH H. LYONS, of the Lyons Machine Co., Cleveland, has been re-elected president of the Northern Ohio Division of the Special Tool, Die and Machine Shop Institute for 1935. HARRY E. BOLLINGER, of the Phoenix Ice Machine Co.,

Cleveland, has been elected vice-president; and EMIL P. HAHN, of the Hahn Mfg. Co., Cleveland, secretary-treasurer.

BORDEN CO., Warren, Ohio, announces that the name of the company has been changed to BEAVER PIPE TOOLS, INC., in order to more closely identify the concern with its products.

Pennsylvania

J. J. MCQUILLEN, Pittsburgh district manager and for forty-five years in the employ of the Morgan Engineering Co., Alliance, Ohio, has been granted a leave of absence. It is probable that Mr. McQuillen will be located in the home office of the company later. S. R. COX, JR., will succeed Mr. McQuillen as Pittsburgh district manager and will make his headquarters in the Oliver Bldg., Pittsburgh, Pa. Mr. Cox was formerly sales engineer of the Hyatt Roller Bearing Co., and previously was connected with the Carnegie Steel Co.

POOLE FOUNDRY & MACHINE CO., 3701 Clipper Mill Road, Woodberry, Baltimore, Md., has appointed the NIBLING ENGINEERING SALES CO., 309 Colonial Bldg, Philadelphia, Pa., representative for Poole flexible couplings and speed reducers in the Philadelphia district.

Wisconsin

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., invited a large number of industrialists, engineers, and manufacturing executives to attend the company's open house and informal luncheon, held at the West Allis works on January 19. On this occasion, some of the outstanding products of the company were shown to the visitors, including the 115,000-horsepower hydraulic turbines for Boulder Dam—the largest hydraulic turbines ever built—and an 80,000-kilowatt steam turbine unit. Electric motors, centrifugal pumps, rotary compressors, Texrope drives, transformers, and rock- and ore-crushing machinery were also shown to the visitors.

DUMORE CO., Racine, Wis., manufacturer of fractional horsepower motors, grinders, and electrical appliances, has acquired and moved into a larger and more modern factory building at 14th, Racine, and Clark Sts. The new quarters have sufficient space to provide for future expansion.

* * *

Those who believe that all we need for recovery is more and easier "credit" will find an article by David A. Weir, entitled "Credit where Due," in the January 2 number of *Commerce and Finance* well worth obtaining and reading.

OBITUARIES

David R. Bowen

David Reese Bowen, vice-president of the Farrel-Birmingham Co., Inc., Ansonia, Conn., and for forty-five years its chief engineer, died at his home in Ansonia on December 29. Mr. Bowen was born in Cwmavon, Wales, October 22, 1865. He received his education in the British national schools and at Llandovery Collegiate School.

David R. Bowen

At the age of seventeen, he came to the United States with his parents, and in 1883, entered the employ of the Farrel Foundry & Machine Co. as a machinist's apprentice. After serving his apprenticeship for three years, he worked as a machinist for two years longer and then entered the drafting-room. During the next ten years, his exceptional ability as an engineer led to his appointment as chief engineer, a position which he held until 1930, when he was elected vice-president in charge of engineering.

In July, 1933, ill health compelled him to relinquish active direction of engineering, and he then became consulting engineer, also continuing to hold the position of vice-president until the time of his death. Mr. Bowen was widely known as an able engineer throughout the fields of industry for which the Farrel-Birmingham Co. builds machinery. He had been a member of the American Society of Mechanical Engineers since 1899.

William W. Macon

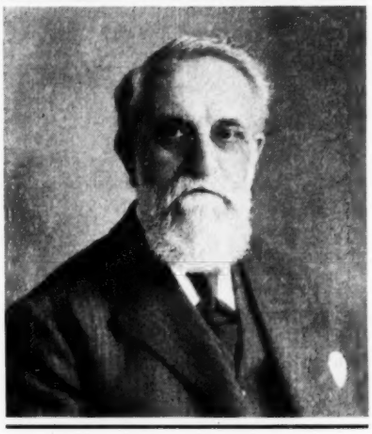
William Watts Macon, for fourteen years managing editor of the *Iron Age*, died January 1 at the Murray Hill Hospital in New York City of a cerebral hemorrhage, at the age of fifty-nine years. Mr. Macon was born in New York and graduated from the Sibley School of Engineering of Cornell University in 1898. At Cornell, he was editor of the *Sibley Journal of Engineering*, and there became interested in the trade-journal field. He was with the *Engineering Record* for seven years; subsequently, he was editor of *The Metal Worker* for six years, and then joined the staff of the *Iron Age*, of which he was managing editor until 1930, when he became editor-in-chief. Two years later illness forced him to relinquish this work and he became consulting editor, in which capacity he was acting at the time of his death.

Mr. Macon was a member of the American Society of Mechanical Engineers, and served on a number of important committees. He was also a member of the American Iron and Steel Institute, for which he studied economic conditions in the iron, steel, and coal industries.

With his marked ability to gather and focus attention upon the important developments in the engineering field, Mr. Macon combined an unusually friendly personality. A host of his friends in the industry will deeply regret to learn of his passing.

Vernon Royle

Vernon Royle, president and treasurer of John Royle & Sons, Paterson, N. J., died December 17 at his home in Paterson at the age of eighty-eight. Mr. Royle was born in Paterson in 1846, eldest son of the late John Royle, Sr., who was long identified with the machinery business in Paterson. In 1868, he became employed in an engraving business which brought him in contact with the early experiments in photo-engraving. In 1877, he decided to join the machinery business then conducted by his father and brother in Paterson, which remained a partnership until 1898, when



Vernon Royle